

More Power for America

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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SEE PAGE 14





You may worry about
the tread on your tires

but here is one worry you can avoid

MAYBE you can't buy new tires, but you can make your old ones last longer by giving them extra care.

And you can make your *car* last longer, too, if you take *extra* care to avoid *extra* wear on your car's king pins, tie rods, steering crank bearings and other vital friction points that means costly repair bills when neglected! Play safe—with Marfak bumper-to-bumper *chassis lubrication* every 1,000 miles!

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Popular Mechanics Magazine

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H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

May, 1942

Vol. 77, No. 5

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If You Can Drive, You Can Fly

ONE lesson and you can fly an airplane. You push the throttle in to the hilt, and when you're rolling, ease back on the wheel and climb. To turn left, swing the wheel left. No pedals to worry about. In a few minutes you're at home in the sky! Sounds awfully simple. Well, one of our staff members, never in a cockpit before, after one trip with a pilot at the controls of the new rudderless, spinproof plane, flew it up and landed it a half dozen times. He's back, alive, to tell you in three articles, beginning next month, that "If You Can Drive, You Can Fly."

The Demon Fire in Disguise

OPENING the faucet of a tank of thinner, an aircraft-factory worker started to fill an empty bucket. It blew up in his face! Fire broke out mysteriously in a ship's hold when a case of photographers' flash bulbs was broken. A whole new set of hazards has arisen in the new materials industry is using. Read "New Disguises of the Demon Fire" in June.

Next Month

SOME day we'll need fewer people than live in New York City to raise enough food for the whole population of the United States. In Revolutionary times 75 percent of the people were farmers; today, 25 percent. Long-range weather forecasts, better control of pests, scientific plant feeding, breeding of healthier plants that produce bigger crops per acre, mechanization of the farms—all these are elements in "The Revolution in Farming" that has made us the greatest agricultural nation. Look for that story in the June issue.

Dogs of War

THEY work twelve hours a night, these army dogs, and like the rest of us they get one night off every week. "U. S. Army Dog Sentry," reads the identification tag on the collar. They go to school to learn their special duties, and night after night they stand guard and walk beats with a soldier patrolling fortified areas. They've more "sense" than a human sentry, you'll agree when you read their story next month.

Shoot Them in Color

INDOORS or out, you can capture a beautiful world of color on film, and it doesn't take a costly array of equipment and a tricky camera to do it. What it does take is explained for you in the June Coloroto section, accompanied by Kodachrome pictures in full color and other photos showing the necessary equipment, exposure guides and other valuable helps.

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"MINE WAS THE SLEEP BEFORE DEATH!"



A true experience of ROLAND WILSON, Littlefield, Texas



"**DESPERATELY TIRED** from a sick-bed vigil, I fell asleep while driving one night," writes Mr. Wilson. "My car swerved from the road... mowed down four heavy highway markers... and crashed with terrific impact against a concrete culvert. Then it made a final crazy plunge to the bottom of an embankment."

"**WHEN I CAME TO**, my car was upside down beside me, a mass of crumpled junk. Spasms of pain wracked my body, and my legs were paralyzed. I realized that I needed help, but I was off the road, so motorists could not see me. Then... I thought of the flashlight I always carry in my car."



"**DAGGING MY USELESS** legs... I managed to reach it. I flipped the switch... turned the light toward the road above and waved it weakly. People in a passing car saw the bright beam... came down and picked me up. I was badly injured, but thanks to dependable 'Eveready' fresh DATED batteries I escaped death."

(Signed) *Roland Wilson*

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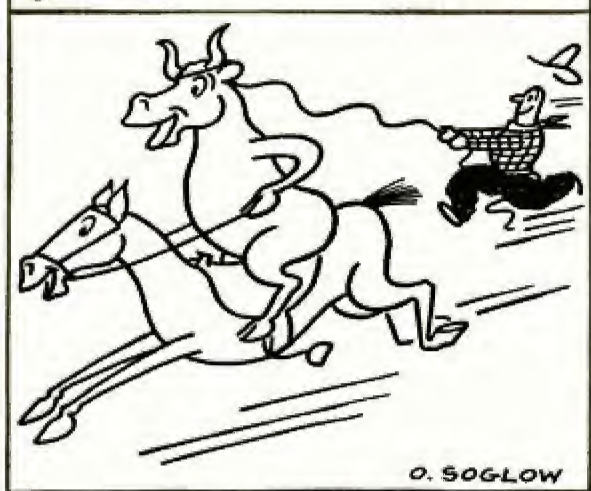
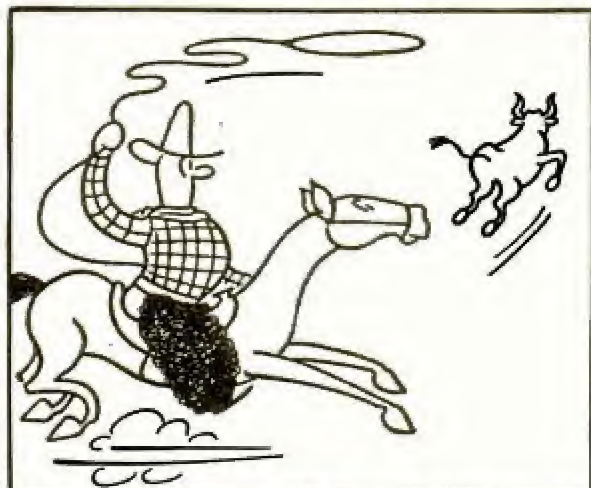
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This Bottle Neck is Your Opportunity



A very real bottle neck has occurred in industry.

The millions of men going to work in the defense industry and business boom need thousands—hundreds of thousands—of supervisors and executives. Expanding Government agencies are calling for many specialists. Regular business needs experts to take care of expansion and to replace men called to military service.

The need is for all sorts of executives and specialists—foremen, supervisors, superintendents, accountants, traffic men, tax experts, time keepers, department managers, auditors, cost experts, production men, etc. The need will grow and continue for years to come.

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That is your opportunity—if you are ready or will get ready quickly. Never again will you have such an opportunity to command the success you want. But you must act decisively—immediately. The more quickly you get ready,

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"I'm IN A CLASS BY MYSELF!"

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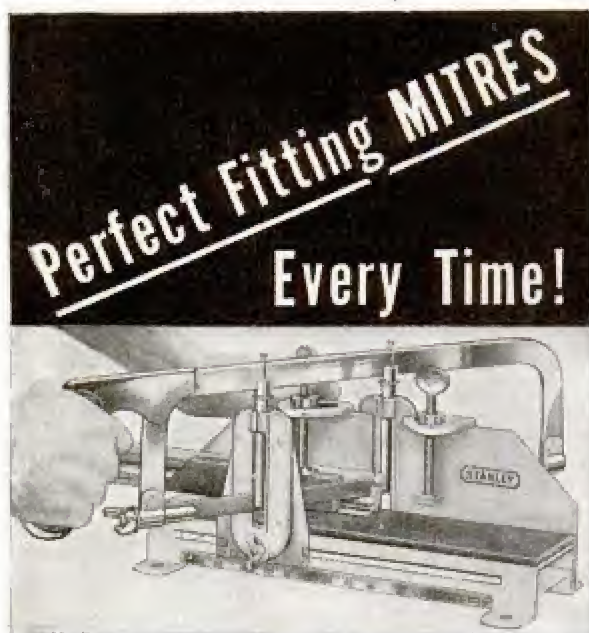
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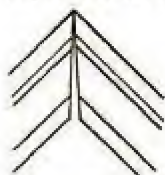
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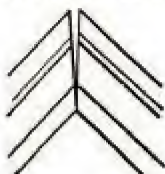


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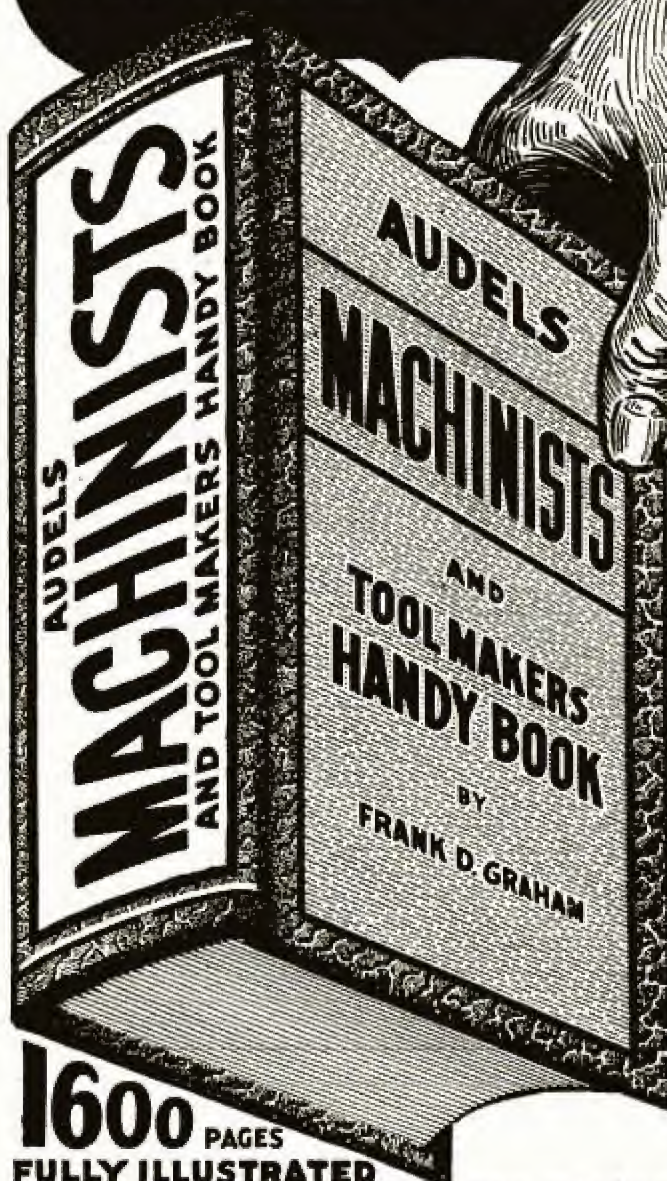
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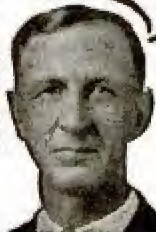
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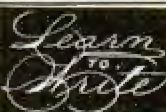
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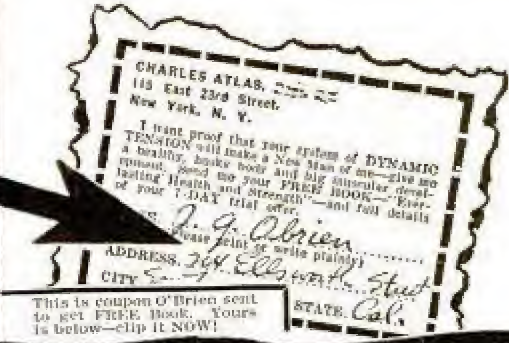
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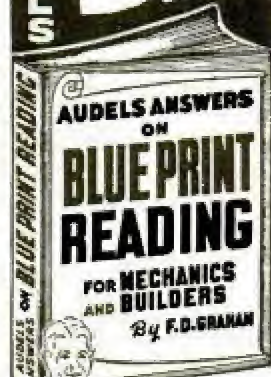
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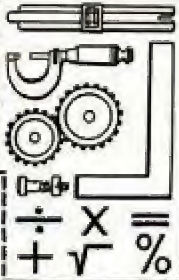
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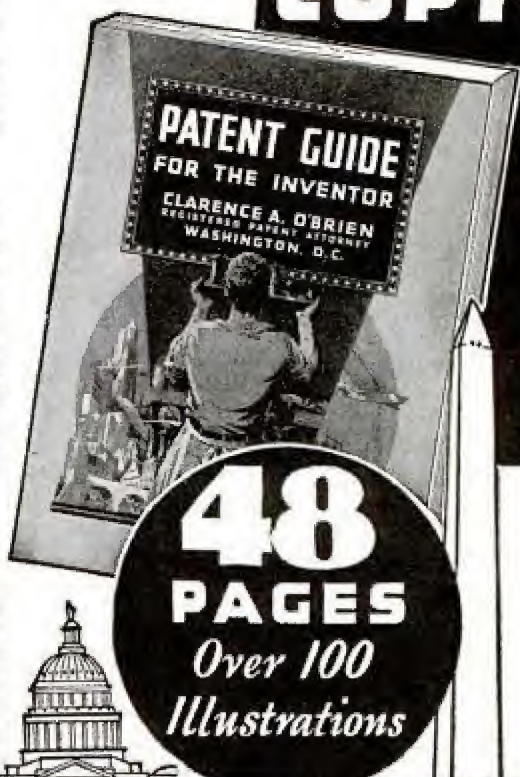
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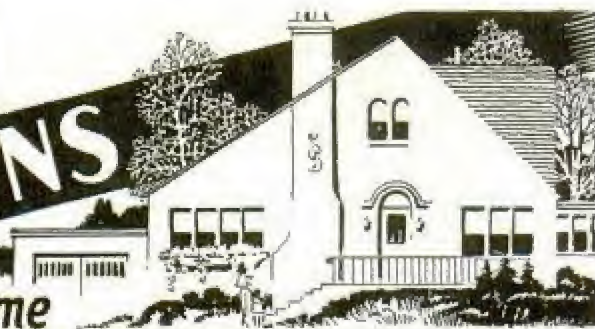
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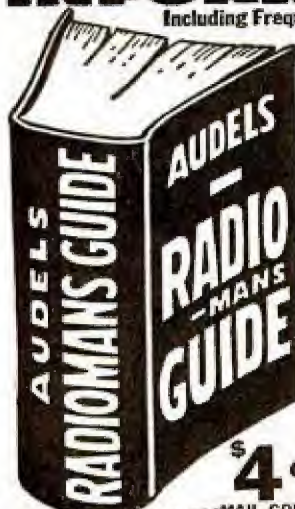
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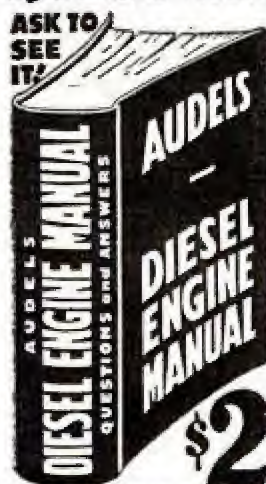
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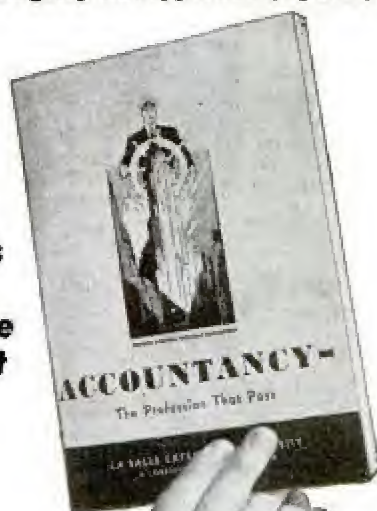
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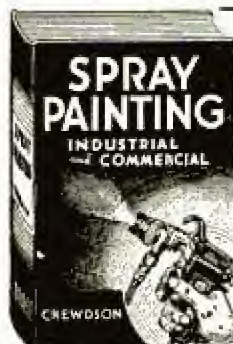
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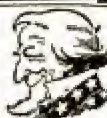
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FREE! 10 Commemoratives! With approvals. (Box 321), Foxlake, Wisconsin.

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HAVE You a camera? Send ten cents for recent number of our big magazine, showing how to make better pictures and earn money. American Photography, 116 Camera House, Boston, Mass.

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ROLLS Developed double set prints 25c. Reprints 25c dozen. Enlarged 18 exposure 45c. 36 exposure 85c. Reduction on new rolls. Eshlemans, 120-08 Liberty, Richmond Hill, N. Y.

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ROLL Developed and 16 prints, or 8 prints and 2 enlargements, 25c. Candid 35mm. film developed and 36—3x4 prints, \$1.00. 18 exposure roll, 60c. Mercury Studios, Dept. 21, 109 N. Dearborn, Chicago, Ill.

ROLLS Developed two prints each and two free enlargement coupons, 25c; reprints 3c each; 100 or more 1½c. Summers' Studio, Unionville, Mo.

ROLL Developed and 4x6 oversize glossy Velox prints, 8 exposure 30c; 12 exposure 45c; 16 exposure 60c. Overnight service. Clemet Photo Service, 1318 W. Columbia Ave., Philadelphia, Penna.

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VICTOR 16mm. Sound on film projector good condition \$150.00. Also Simplex magazine loading 16mm. camera, 3.5 lens \$40.00. Doris Weber, Webster, N. Y.

16MM. SOUND National anthem trailer \$4.95; Victor sound projector complete \$129.50 (terms \$3.42 weekly). 8x10 portable professional screen, with collapsible stand, (reg. \$125.00) \$34.95. 16mm. sound projectors bought, sold, exchanged. Terms. Nationwide circulating film library 16mm. silent, sound; 8mm. Mogull's, 64 West 48th, New York City.

WANTED: Used equipment for cash. Films, cameras, projectors, etc. Peters, 41-C South Fourth, Allentown, Penna.

MOVIE Films—Cheap! Free catalogue! Superior, 126 Fourth, Paterson, N. J.

AMBITIOUS? Show talkies theatres less communities. Sound equipment. Weekly programs rented reasonably. Roshon, State Theatre Bldg., Pittsburgh, Penna.

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8MM-16MM Films. Free catalogue (sample film 10c). Parkway Exchange, 961 Eastern Parkway, Brooklyn, New York.

35MM. Odd reels 75c. Projectors. Features. Savarese, Woodcliff Lake, N. J.

SAVE 50% On movies. Bargain circulars. Genera Company, Davenport, Iowa.

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SEND Stamp for 16mm., 8mm. catalogue. Sterling's, 679 Northampton, Easton, Pennsylvania.

USED 16MM. sound film—100 feet, \$1.00, postpaid. Blackhawk Film, Davenport, Iowa.

BASS Says: Shrewd buyers send for the new Bass Cine Bargaininggram No. 245, an 84-page catalog exclusively cine. The new Revere Double 8 with F3.5 lens at \$38.50. Is the buy. The RCA 16mm. 80F news reel camera at \$275.00. Write Cine Headquarters for your copy of this great free book. We pay cash for good used movie equipment. Bass Camera Company, Dept. A, 179 W. Madison St., Chicago, Ill.

FILMS Exchanged: bargain lists 3c. Hoffman Cut Rate Films, 57 Broad, Albany, N. Y.

ASTONISHING. Exotic Kodachrome subjects. Lists, sample, dime. Erwine's Enterprises, Allentown, Penna.

LEARN Movie projection, management. Free catalog. Give age. Theatre Institute, Elmira, N. Y.

NATIONALLY Advertised 8mm.-16mm. movie cameras, projectors, films. Cash or terms. Send stamp for catalogue. Don Elder's, M-739 Boylston St., Boston, Mass.

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SONG Hits! Send poems for free examination. Write for free de luxe rhymers. DeLuxe Music Service, Box 3163-P, Bridgeport, Conn.

SONGWRITERS—Send poem for immediate consideration and free rhyming dictionary. Richard Brothers, 24 Woods Building, Chicago.

LYRICS Wanted, song composed. Beginners proposition. Basil Alt, Ottoville, Ohio.

SWING Piano by ear!—Write your own songs. Fascinating new method by popular Hollywood swing pianist-composer. Free details. Write today. Harmony House, 715D Haas Bldg., Los Angeles, Calif.

SONGS—Composed, arranged. Complete Song Service, Box 113, Kalida, Ohio.

LEARN Popular piano! Write Magic Key, 111-A Broadway, Glendale, Calif.

SONGS—Song poems wanted. No charge for melodies. Free examination. Hollywood Recording Studios, 87 G16 Preuss St., Los Angeles.

PHONOGRAPH Records 10c. Catalogue. Paramount, AY-358 East Market, Wilkes-Barre, Pennsylvania.

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SONG Poems wanted. Submit for consideration. Five Star Music Masters, 630 Beacon Building, Boston.

NEW And used accordions and wind instruments bought and sold. Complete factory repairs on all instruments. Ace Music Co., 307 So. Wabash Ave., Chicago, Ill.

SONG Poems wanted for musical setting. Free booklet. Write today. Song Service, 331-C West 46th, New York.

SONGS. Poems wanted. Newart Song Publications, 1207 Carbon, Syracuse, N. Y.

PHONOGRAPH Records 10c. Free list. Hoodwin Company, 4419 Broadway, Chicago.

SONGWRITERS—Write for free book. Send song poems. Variety, Salem, Ind.

SONGWRITERS! Words, melodies. Amazing offer. Hibbeler, C-5, 2157 No. Avers, Chicago.

SONGWRITERS. Write for free booklet. Profit sharing plan. Allied Music, 7608 Reading, Cincinnati, Ohio.

WANTED! Lyrics, melodies for songs. We arrange, publish, sell. Superior Song Studios, Passaic, N. J.

MUSIC Composed to words. Wonderful proposition. Bauer Bros., Oshkosh, Wis.

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MUSIC Composed to words. Rhyming pamphlet on request. Phonograph recording of completed songs. Send poem for consideration. Keenan's Studios, Dept. PM, Box 2140, Bridgeport, Conn.

SONG Poems wanted. Free examination. McNeil, Master of Music, 610-PM South Alexandria, Los Angeles, Calif.

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SIGNS And showcards easily and expertly painted with letter patterns. Many sizes and styles. Write for descriptive folder. John Rahn, A1330 Central Ave., Chicago.

MAKE Money by mail, the way we do. Free information. Maywood, 1133 Broadway, New York.

GO Into business. Achieve ambitions, make plenty money, be commercial giant. Free circular. Green, 622-A Box St., Buchanan, Mich.

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MONEY Making sensation. Sell birthday card assortments 30c up. Request famous all occasion \$1 box on approval. Hedenkamp, 343 Broadway, Dept. G-5, New York.

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PROFITABLE, Dignified business for high grade industrious men and women retailing Rawleigh products direct from manufacturer to consumer. Every home your market. Large repeat orders. A few openings nearby. Write Rawleigh Co., Dept. E-85-PPM, Freeport, Ill.

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BEAUTIFUL V victory buttons on patriotic cards. Dollar bill brings 24. Retail \$2.40. Victory Button, St. Paul, Minn.

GREETING Cards, specialties. Hildebrand's 4554 North Uber Street, Philadelphia, Pennsylvania.

MAKE Extra money easily, selling ten different greeting card assortments. Freeman, 35 High, New Haven, Conn.

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AGENTS—Silk and Nylon hosiery. Big stock; complete line; all sizes. Selling like wild. Whirlwind profit opportunity. Replacement guaranteed. Your own hose free with large outfit. Rush hose size, name today. Wilknit, Desk CE-37, Greenfield, Ohio.

AGENTS. Big line including food products. Fast selling premium and bargain deals. Low prices. Send card for big outfit offer with gift. Ho-Ro-Co, 2715 Dodier, St. Louis, Mo.

BIG Money taking orders; shirts, ties, hosiery, underwear, pants, jackets, sweaters, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AN Lincoln, Chicago.

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SPECTACULAR Demonstrator. Make-sell sensational new cleaner. Details. O-Belfort, Engineering Building, Chicago.

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AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address. 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

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BIG Money applying initials on automobiles. Easiest thing today. Free samples. If you sell printing and advertising specialties we have an excellent sideline featuring Decalcomania name plates in small quantities. "Ralco," 727 Atlantic Ave., Boston, Mass.

DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents," is filled with proof. I'll gladly send you a copy free. P. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

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MAN With car to establish retail store route. Openings almost every locality. Handle orders for nationally known manufacturer-jobber. Average 50% commission. Steady big pay opportunity. Sales experience unnecessary. World's Products Co., Dept. 105, Spencer, Ind.

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UPHOLSTERY And rug cleaner sells easy—big repeater—quick, safe, economical. 50c package makes gallon liquid. Send dollar for three packages. Trial size full particulars free. Rite-Away Products, 310 West Burlington, Milwaukee, Wisconsin.

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"UNCLE Sam" jobs. War greatly increasing appointments, \$24.23 to \$40.38 week. Men-women. Prepare immediately for examinations. Full particulars—list positions, free. Write today. Franklin Institute, Dept. K2, Rochester, N. Y.

WELDING Opens the way to good pay and future in important industries. Growing need for trained welders. Prepare now. Practical, personal training spare time at home and Chicago. Write for free facts. Utilities Engineering Institute, 1314 Belden, Dept. 125, Chicago.

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TOOL Designing pays big. Home study course. Low cost. Easy terms. Free booklet. Ohio Institute of Technology, Box 56, Greenville, Ohio.

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MEN, Try next railway mail clerk exam. Regulars start \$1900 yearly. Complete training, only \$9.75. Write. Oxment Instruction Service, 101, St. Louis, Mo.

CLINICAL Laboratory technic taught in your own home. Practice outfit supplied. Bulletin free. Imperial Technical Institute, Box 973-E, Austin, Texas.

LEARN Telegraphy! Splendid opportunities now prevail. All expenses low. Catalog free. Dodge Institute, Dept. M, Valparaiso, Indiana.

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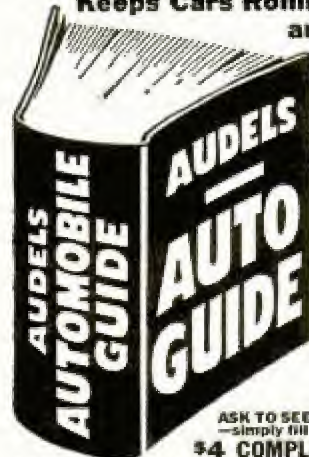
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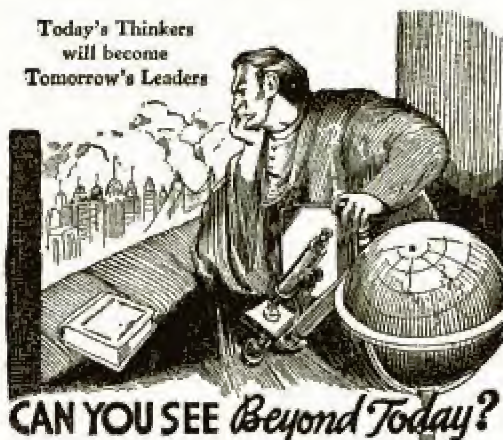
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Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 77

MAY, 1942

No. 5

By Dr. A. A. Bates

Westinghouse Research Laboratories

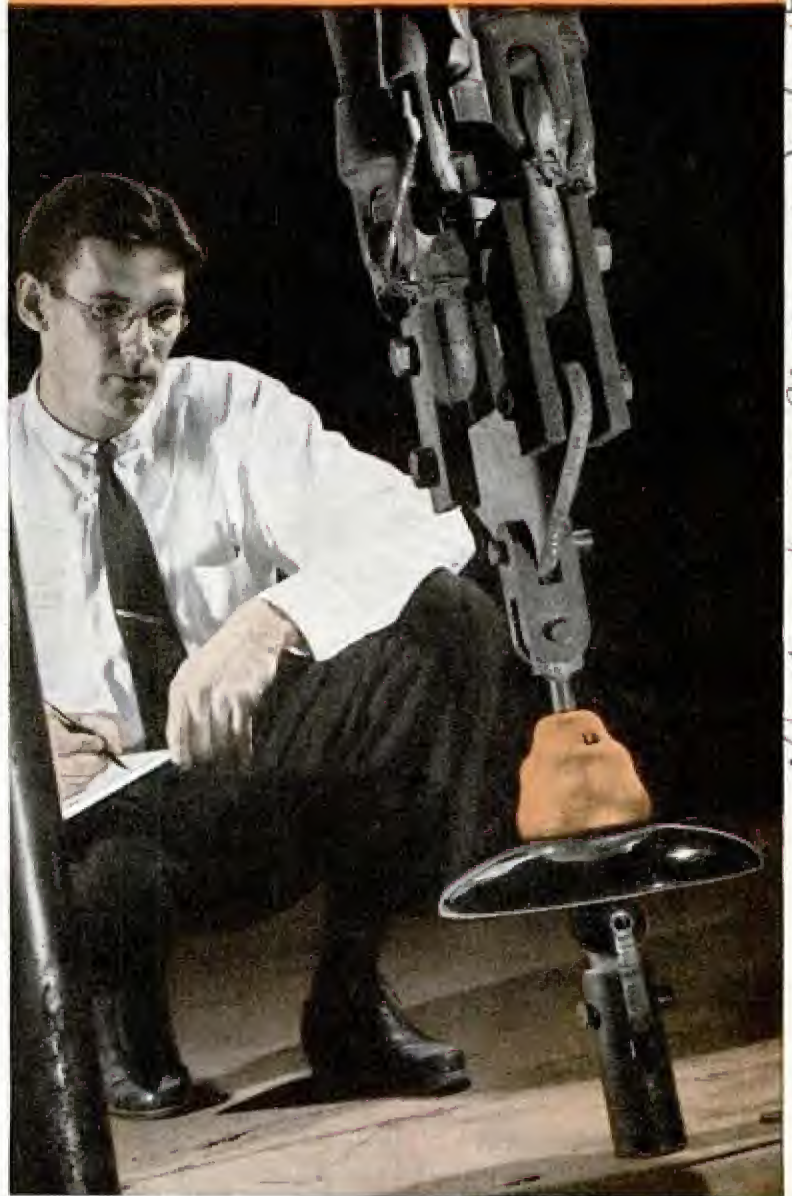
IN SEARCHING for substitutes for the many materials now being poured into the funnel of our all-out effort against our enemies, American scientists are discovering many new things so good they probably will be preferred after the war to materials for which they are now pinch-hitting.

For instance, we might consider the "Cinderella" metal, molybdenum, new plastics that are taking over some of the jobs once performed by metals, and the revelation through research of new ways to improve such materials as steel, porcelain and metal platings.

At present the all-out search for substitutes seems like a mad scramble for things that will do in a pinch. For example, national defense and now war priorities have forced the substituter in some cases to turn to such rare metals as silver. But out of this scramble are bound to come lasting benefits to America, just as the emergency of 1914-1918 produced many of our most useful alloy steels and the light, strong alloys of aluminum.

Because America has almost a world monopoly on molybdenum, this

SUBSTITUTES WE'LL KEEP



Porcelain insulator coated with new glazing material is shown here in "puller-apart" machine as Dr. Ralston Russell, Jr., records the results

MAY, 1942

1

*P 1415 Leggett
Westinghouse Electric & Mfg Co, E. Pittsburgh, Pa*

21415



Metals reclaimed from Westinghouse machine-shop shavings, punchings and other leftovers are melted in gas-air furnaces to produce 20 tons of ingots per day; the "metal hash" is cooked at temperatures from 1,800 to 2,300 degrees Fahrenheit

al platings—we have always had to depend upon supplies from abroad. Partial or complete interruption of the flow of these supplies by our enemies seems certain.

Most of our tungsten comes from Burma and China, tin from Malaya and Bolivia, chromium from Turkey and Africa and manganese from Russia and India. The great stores of the world's nickel are in Canada and, although the war cannot easily interrupt our trade with that country, she is obligated to make her

metal seems destined to play a leading role in a new drama of steel making. This country is well blessed with resources of the base metals—iron, lead, zinc, aluminum and copper. But for nickel, chromium, manganese and tungsten—used as alloying elements added to iron to produce steel of strength, hardness or workability—and for tin—used in solder, bronze alloys and met-

supply available first to England.

As our supplies of these metals have dwindled with the spread of the war, they have been placed one by one on the priority lists by government authorities so that our defense and lease-lend programs—and now our all-out war effort—would not suffer from want of strong alloy steels for shells, tanks and guns.

Dr. Bates shows how plastic nose fits onto projectile for an antitank weapon



After ores have been purified to form pure tungstic oxide, the oxide powder is put into pans for drying in ovens



21415



Refrigerator with evaporator door made of porcelain enameled steel with plastic facing

In an effort to maintain, as far as possible, the manufacture of its non-war products, metallurgists at Westinghouse have been searching for ways to utilize molybdenum instead of the priority-bound metals. Since the United States produces nearly 90 percent of the world's molybdenum, it does not seem likely that this country will ever suffer from a scarcity of this metal. The largest molybdenum mine is in Colorado and there are other deposits in Utah and Arizona. The metal is a newcomer to the production line, partly because our great stores of it were discovered in comparatively recent years and partly because of great difficulties which metallurgists experienced at first in learning how to produce and heat-treat alloys containing molybdenum.

At Westinghouse, and elsewhere, molybdenum is being employed in place of nickel, which has been used for many years as the strengthening element in steel for shafts, bolts, gears and other highly stressed parts of such machines as motors and generators. Because nickel steel is now in great demand for shells, the newer molybdenum steels are substituted where possible in making these tough parts of machinery.

Similarly, when tungsten was



Carrying a 20-pound insulator on head helps speed production

Molybdenum steel-tipped cutting tool shaving off layer of steel





Study of light-transmitting plastic bars may result in illumination of post-war homes with plastics connected to central light source

added to the list of strategic materials, a substitute was needed for high-speed tool steel, containing about 18 percent of this metal. The substitute was found and now various sections of Westinghouse plants are using tools made of molybdenum steel, containing only a small amount of tungsten. The new alloy is equal in quality to its predecessor and is less expensive—indicating that it may replace for all time the straight tungsten steel for many purposes where it was formerly considered indispensable.

Nickel and chromium, as well as tin and zinc, are among the favorite plating materials, which protect steel and other metals from rust, corrosion and tarnish. As these metals went on the priority list it became necessary to find substitutes. Then substitutes for substitutes had to be found.

Micarta bearings, made of plastics, ready to be shipped to steel mills where they will outwear previously used metal bearings many times

For example, the cover of one type of electric roaster was originally made of aluminum. First, plans were made to substitute stainless steel (containing chromium), but before these plans were put into effect, it appeared that stainless steel would become scarce and new plans were laid for the use of chromium plating over nickel plating. Then nickel and chromium priorities ended those plans. Now, as coverless roasters pile up in warehouses, engineers are working on an enameled steel cover.

In a few cases, engineers have resorted to the use of silver, one of the very few metals not affected by priorities regulations. A stainless steel part of a thermostat has been replaced by silver. Ordinary paint has partly replaced galvanizing (zinc coating).

Westinghouse has made many substitutions for aluminum. Nearly every bit of this metal has been removed from electric refrigerators. Ice-cube trays are now made of rubber. Glass and enameled iron have been substituted for aluminum in dishes, trays and other parts. Broiler pans and deep-well cookers on new ranges are made of enameled iron. Waffle-iron grids are made of cast iron. Plastics have taken the place of aluminum in washing-machine agitators, vacuum-cleaner nozzles and parts of other appliances.

(Continued to page 184)



m131 *Conr. Warner Egden* *Knoxville*
2519 Jefferson Ave *Tenn*
Pneumatic Auger Aids Army Demolition Work

Clearing away bridges, small dams and roadways in the reservoir area of the new Cherokee dam in Tennessee gave army engineers an opportunity to test new demolition equipment. One of the implements was a pneumatic earth auger that quickly bores holes about a foot in diameter for placement of explosives. Working as under battle conditions, engineers set and shot some of their charges, completely demolishing in a matter of minutes many structures which might have been of strategic value to an advancing enemy.



m136 *K-M portable earth* *real ap.*
 Pneumatic auger speeds setting of dynamite charges by demolition squad

The General Air Conditioning Corp. *Cincinnati Ohio*
Circulator Dries Air in Damp Rooms to Prevent Mildew

Capable of servicing up to 2,000 cubic feet of air space, an air circulator now available removes moisture from the air to prevent mold, mildew and condensation in damp rooms. Moisture is absorbed by carbon-containing chemicals furnished in small cubes. Ten pounds are sufficient to

absorb 10 to 15 pounds of water which drips into a container beneath. A built-in fan draws the air over the chemicals and redistributes it throughout the room. It also reduces the musty odor associated with mold and mildew. The unit measures 12 by 14 by 25 inches.



Chemicals in circulator remove moisture from air

MAY, 1942

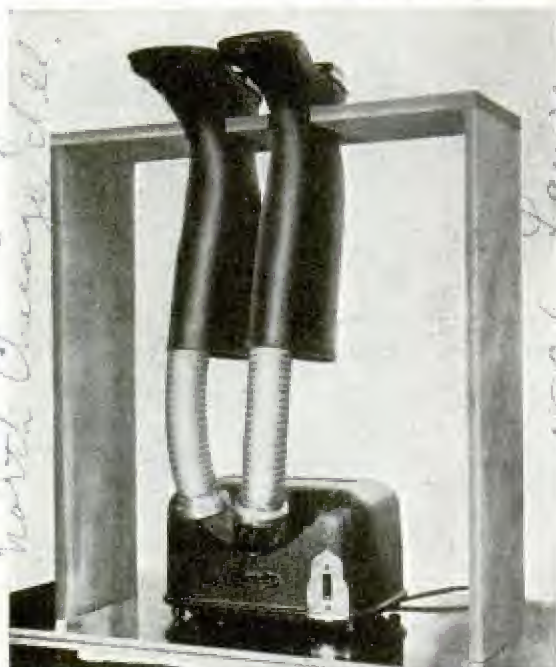
m158
Tin Cans Help Recover Copper From Mine Waters

Getting copper from old tin cans sounds like a miracle, but it really is a simple chemical process. The cans may be exchanged for an equal amount of copper by cutting them into small pieces and tossing them into mine waters containing copper sulfate. Iron sulfate is formed and flows away, while the copper, being precipitated on the metal pieces, is saved. Indicating that there has been a chemical exchange, and not a miraculous transmutation, the mine water loses its bluish color by the extraction of the copper and becomes yellowish from the addition of iron and tin. Cans will be available for this purpose even if they undergo detinning to recover the much needed tin, since the metal left after detinning is not regarded as good scrap because of the tin remaining in it.

Defense Plant Corp
811 Vermont Ave.
N. W. Washington

m114

Electric Blower Saves Time Drying Safety Equipment



Heated air from blower drives moisture from boots

Drying safety equipment after it has been sterilized sometimes causes loss of time in industries where the same equipment is used by different persons. With a new type electric dryer it is now possible to dry equipment such as rubber boots, respirators, gas masks and goggles in three to five minutes. Operating on 110-volt current, the blower is equipped with a double hose connection that carries the heated air into every crevice of the equipment.

Homebuilt Body on Motorcycle Carries Two Passengers

To solve his dual problem of having economical transportation between his home and work, and being able to take his wife

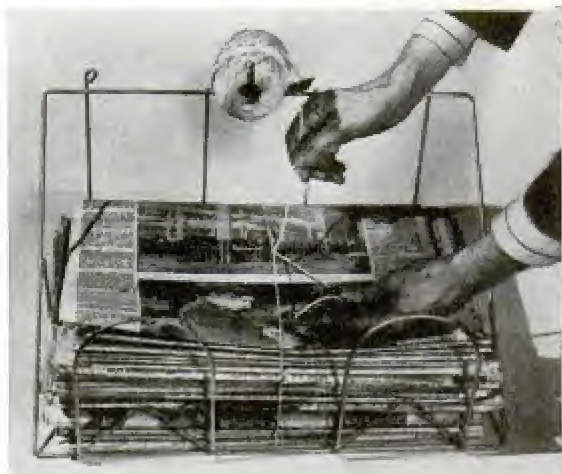


Entrance to the body is gained through door in rear

Harley. Handson Merri cycle
3700 W. Juneau
and youngster on occasional pleasure trips, E. Willard Fiske of Lockport, Ill., converted a three-wheel motorcycle into a passenger car. Removing the steel box at the rear, he replaced it with a body seating two people. The top was extended over the front, and with .040-inch Pyralin stock, such as is used on airplanes, a windshield was installed. In the door there is a window that may be raised and lowered, and between the driver and occupants are two glass panels that slide sidewise to open and close. When the car is to be used for hauling tools and equipment, the seat cushions may be removed. The springs required only the addition of one leaf. Carrying two passengers and driver, the car travels 65 miles per hour and makes 45 to 50 miles on a gallon of gasoline.

Home Baler for Newspapers Simplifies Tying Bundles

Made of heavy wire, a newspaper baler for home use includes a holder for a ball of twine and a cutter. Placed on the floor, a table or a shelf, or hung on the wall by strong rings at the top of the frame, it of-



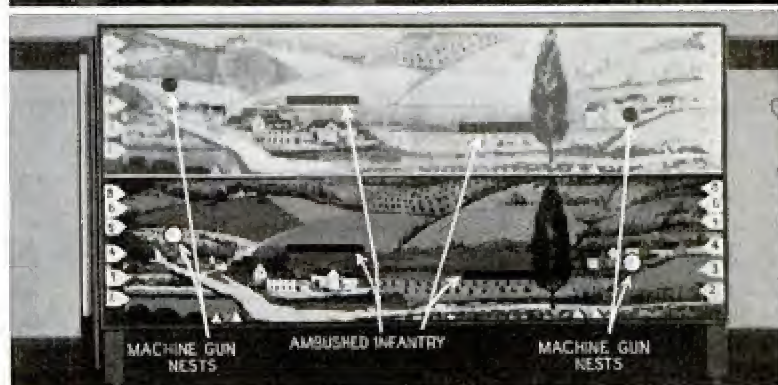
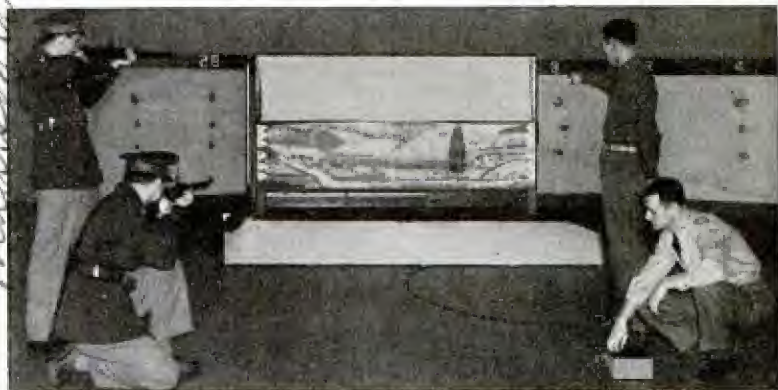
Newspapers can be tied without removal from rack
fers a convenient place for keeping old newspapers as they accumulate. When fully packed with papers the baler holds 25 pounds, which can be tied together quickly and the cord cut by drawing it against the cutter's edge. The cutter consists of folded metal, housing a replaceable razor blade with its edges guarded to prevent injury.

(To learn where to buy commercial products described in these pages, see the index.

*m 112 Cnr. Walter E. Werwath
1027 W. Johnson St. Madison Wis*

Flashing Target Simulates Enemy Battle Line

Lights flashing at split-second intervals on a landscape target help to make marksmen of R. Q. T. C. cadets at the University of Wisconsin's 1,000-inch indoor rifle range. The arrangement of lights brings "blitzkrieg" atmosphere and the element of surprise to target practice, and trains both officers and men to fight confusion when attacked from all sides. The lower half of the target consists of a scene painted in color and studded with two round lights representing machine gun nests, and two long, thin lights that simulate ambushed infantrymen. The cadets aim at these, but the sights of their rifles are set so bullets hit 23 inches above, on the upper half of the target, which is a duplicate of the lower section printed in black and white. Scoring sheets placed over the locations corresponding to the lights on the lower part record the marksmanship of each squad. To prevent seeing where bullets are hitting, which cannot be seen in actual battle, a canvas is drawn over the upper half until firing has ceased. Twelve men in a squad divide up the hedge, each covering his portion by shooting at three points within it. While firing continues, the officer at the controls may flash one of the



Top, squad firing at target while officer blinks lights; center, back of target with lights in place; bottom is target with curtain raised

lights representing a machine gun nest, providing a test in fast thinking for the sergeant leading the squad, who must then assign enough of his men to cover this new point of attack to maintain his fire superiority. The rifles used are .22 caliber.

Flexible Plastic Photoflash Bulb Is Filled With Oxygen

Flexible cellulose acetate substitutes for glass in a new photoflash bulb which produces a highly intense light and therefore can be made smaller than the conventional glass bulb. Accidental explosion of the bulb would be harmless since there is no glass to shatter, and the plastic material

withstands shocks so well that it needs no special packaging. The bulb is filled with the usual metal foil, and oxygen under pressure is injected to make the foil burn with great intensity. A patent on the bulb has been assigned to the Westinghouse Electric & Manufacturing Co.

MAY, 1942

Patented. Michael J. Neumann de Mattita. New York

E. Pittsburgh, Pa

*New York Times
2/8/42*

*Donnell by U.S. Army Sgt. W. V. Webb
Ray Harris*

L1239

Leggett

"The MARINES have LANDED ---"



U. S. Marines and soldiers dashing ashore through the surf with guns ready in joint landing exercises

LANDING on a strongly defended enemy coast—perhaps the most difficult operation of modern warfare—is the task for which Uncle Sam's marines have been, and still are preparing.

Deepest secrecy necessarily shrouds the training and development of methods. Working with army and navy forces which would cooperate with them in a major landing effort, the marines have been developing methods as unusual as anything

uncovered by the European war. Their objective has been the creation of a formidable force with greater speed and mobility than any the world has ever seen—a force capable of striking from the sea and the air to seize and hold hostile beaches until supporting troops can arrive.

To reach land in safety in the face of enemy fire calls for equipment that will transport the marines and their weapons across open water at the utmost speed—

troop-carrying trucks that can swim and specially designed barges for carrying artillery and tanks to shore, and all constructed so that unloading is a matter of minutes, rather than hours. Other equipment must be available for dropping hundreds of heavily armed men by parachute and glider to seize open fields upon which troop-carrying planes may land.

One of the latest vehi-



Sea-going tanks are these and highly useful in landing operations

21239



Philadelphia Inquirer photos

Marines, above, are advancing beside a light tank in maneuvers
Cargo nettings swung over the side of a ship enable U. S. Marines to climb aboard or leave the vessel for landing boats

cles to join the marines is the Roebling tractor which travels on land and water with equal ease while loaded with fighting men. Tank lighters, on which one or more tanks can be transported, already are in use. Marine engines propel the lighters from ship to shore at high speed. Built so their bows can be thrust high on the beach, the lighters have ramps which can be lowered quickly for the tanks to unload under their own power and begin fighting. Thirteen-ton tanks may be carried by these lighters; not far in the future may be lighters for tanks twice as heavy.

Just how could a landing operation be carried out? Secret methods cannot be disclosed, but in general the operation might proceed in this manner:

An expeditionary force—a strong naval force, including aircraft carriers, accom-



21239



at new River, N.C.

Hauling artillery piece along beach in joint maneuvers of marines and soldiers

panying troopships—would approach the enemy coast. First would come bombardment of the beach and adjacent areas to drive enemy forces away from the territory to be occupied. Big guns of battleships and cruisers would blast away, perhaps for hours. Then the transports would move closer and landing boats, amphibious tractors, tank lighters and artillery barges—probably preceded by swift “mosquito” boats—would sprint for the beach.

Specially trained troops, armed with grenades, machine guns, automatic rifles and other light equipment, would spring

Official U. S. Navy photo

from the landing boats and attack enemy machine-gun nests. Light tanks would lumber from their lighters to charge defense works, light artillery would be wheeled from the barges and put into action. Wave after wave of men would follow, as the landing craft continued to pour troops and equipment onto the beach. In the early stages of the operation, parachutists would drop from the skies to assemble into units of automatic riflemen and machine gunners for an attack on an airport or open space where gliders and planes carrying more heavily armed infantry and equipment might land. Here is where speed is vital—all forces must be whipped

Crocodile
Three Marine Corps boats hit the beach carrying tank and two military vehicles



Reconnaissance motor truck

POPULAR MECHANICS

13 1/2 ton tank

armored reconnaissance tank

Lake Pontchartrain, New Orleans, La.



Marine Corps 'chutists boarding plane with folding bicycles in sections. In actual warfare separate 'chutes would be attached to cycles



Marine Corps 'chutist demonstrates how he would be prepared to ride off behind enemy lines on quickly assembled folding bicycle after landing

into an organization able to defend the airport against counterattack and this must be done without a lost moment. Then can come more planes with reinforcements and heavy guns and light tanks.

If the enemy could be pushed back far enough to make the beach-head fairly safe, engineers would construct sturdy docks on which still heavier equipment could be unloaded—a necessary operation because each man in the field requires several tons of equipment, including large-caliber guns and tanks. At this point the Marines might be said to have the situation well in hand.

The Marine Corps has been developing another new fighting organization, which also is composed of specialists. Known as the defense battalion, its job is to dig in and hold a specified area against numerically larger attacking forces. This unit is intended to be sent ashore to hold islands or ports vital to the American Navy. Batteries of long-range naval guns are part of the battalion's equipment for protection against enemy attacks from the sea and speed in mounting these guns is a part of the unit's training. Machine guns are employed against enemy infantry and anti-aircraft guns against air raiders.

Since speed and mobility are two necessary qualities in operations of Uncle Sam's

Westfield Columbia Company Westfield Mass
marines, the "triangular" organization is employed. Instead of the cumbersome division consisting of some 25,000 men just after the World War, the 1942 division is composed of about 15,000, including three infantry regiments and one organic artillery regiment. The smaller force is, of course, easier to handle, making for speed.

The Marine Corps has been training pilots, mechanics, gunners and parachutists as rapidly as facilities and equipment became available. The flying marine learns to handle land and sea planes and to take off and land from the tossing deck of an aircraft carrier and rocky landing fields perhaps carved from the jungle. But the most recent development has been the parachutist and the air-borne infantry. Work in this field, too, is secret, but it is known that the Marine Corps has been perfecting an organization to exploit the possibilities of principles established in the successful air attack on the island of Crete by German 'chutists and plane-transported soldiers. Candidates for 'chute units must be young men of specially robust physique and unusual activity; their course consists of jumps from platforms set a few feet high, then from towers arranged so that captive parachutes may lower them to the ground and finally from airplanes. Special

L1239



Above, Marine leaping from amphibious tractor in semblance of landing operation. Right, practice with bayonets at Marine Corps base

troops and shock troops for landing behind enemy positions.

Always maintained in a state of readiness, the Marine Corps today probably could put at least an entire division, with complete equipment, on an enemy coast faster than any other military organization in the world. Even in its early history, the Marines could embark a fully equipped battalion aboard ship on 24 hours' notice; today they can do it even faster—the result of constant training, planning and research.

equipment is carried by the 'chutists so that they may go into action the instant they touch the ground. In addition to a formidable array of weapons, the parachute troops may be expected to carry a supply of folding bicycles on which they would be able to reach an objective, or protective cover, more rapidly than they could on foot. Machine guns and other equipment which would be too heavy for the individual to carry are dropped by separate parachutes.

Marine Corps officers and enlisted men are being trained in preparation for immediate development of a glider division. It is understood the marines will use large gliders for supplying ground troops from the air and as transports for parachute



Age of Adirondack Mountains Is Over One Billion Years

Recent investigations by Dr. J. P. Marble at United States National Museum at Washington, D. C., have checked the age of the Adirondack mountains at approximately 1,100,000,000 years. This conforms with a previous finding in Vienna determined from the uranium-lead content of specimens of uraninite some three years ago. Dr. Marble's study was made with a mineral known as allanite, which contains thorium, a radioactive element. Like uranium, it degenerates into lead through radioactivity, but at a considerably differ-

ent rate. The fact that different materials having different decay rates were used in the two analytical tests, is regarded as convincing proof that both calculations are highly accurate. The calculated age represents the time that has elapsed since the rock materials which make up the mountains were brought together in their present position. Literally a "rock of ages," these mountains were formed, according to this evidence, long before anything remotely like life, as it is known today, existed on the earth.

National Research
Council Committee on Measurement of
Geologic Time

Right Way to Fall Into a Net Taught Firemen

Auxiliary firemen being trained for civilian defense in Chicago must learn the rudiments of rescue work as well as firefighting methods. One lesson teaches the correct way to fall into a fire net. The firemen learn that one who jumps to safety from a burning building should spread out the arms and legs in order to distribute the shock and avoid injury upon striking the net.

This "all-point landing" is recommended by instructor when falling into a fire net. Such a landing averts injuries which might result if arms or legs strike first



Shingles Are Made Fire-Resistant With Chemical Coating



Flames still lick across untreated shingles long after gasoline has been burned from the fireproofed portion leaving it cool

Fireproofing properties of a chemical developed for use on inflammable war materials were demonstrated recently on a specially built shingle roof. Only half of the roof was given the flameproofing treatment, after which the entire roof was sprayed with gasoline and ignited. The untreated side kept blazing long after the gasoline had burned away from the treated shingles.

Plastics Substitute for Tin In Collapsible Tubes

Your tubes of ointment and toothpaste and shaving cream soon will be made of plastics or metal alloys instead of the tin made precious by war in the orient. One manufacturer has developed a plastic tube which can be made from several synthetic materials, and is being tried as a container for such foods as catsup and peanut butter. Another is bringing out a pliable tube made of a secretly compounded metal alloy.

MAY, 1942

m135

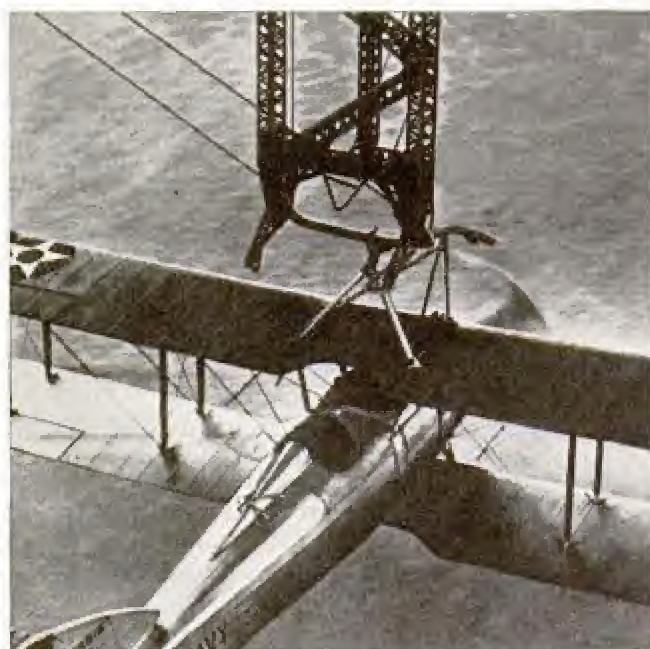
FLYING CARRIER



Cutaway view of flying carrier for bombing planes

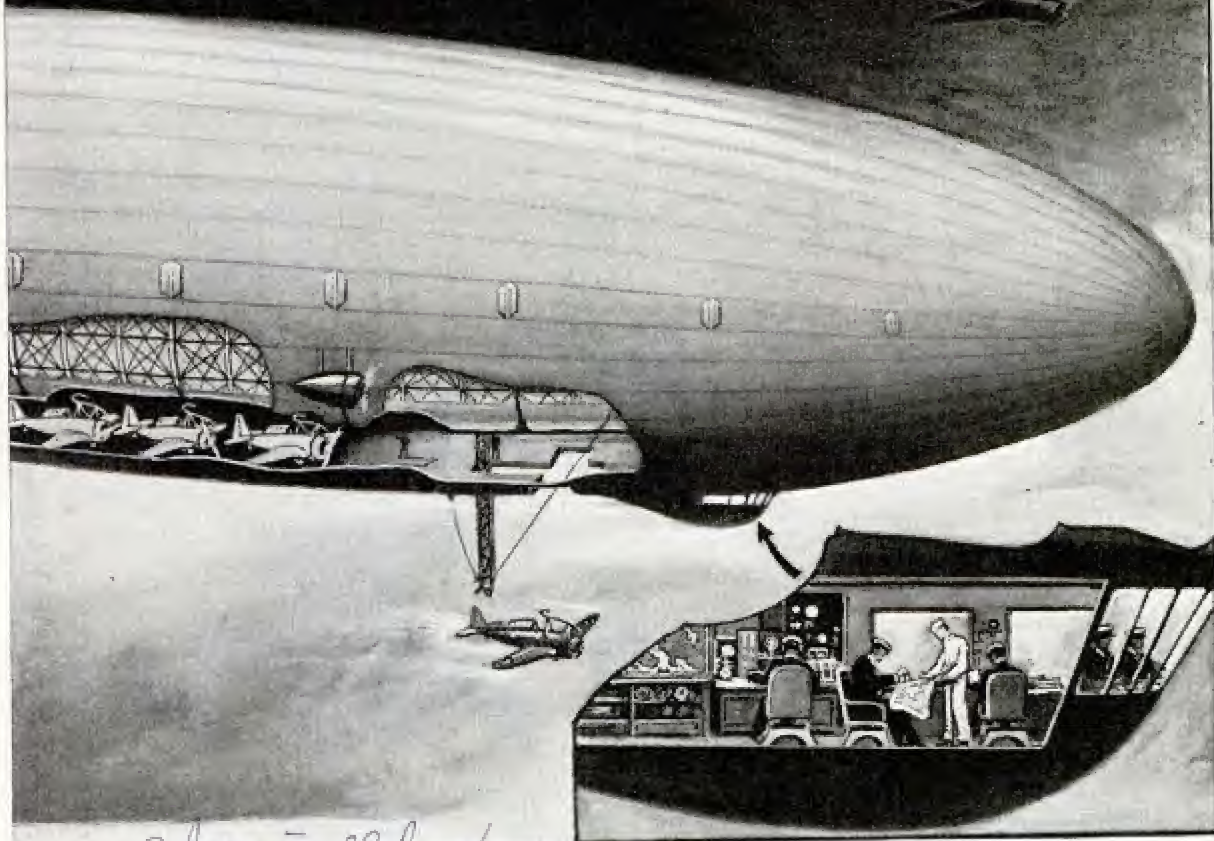
Courtesy Goodyear Co.

Closeup of hook-on arrangement, which permits airship to launch and pick up planes, employed in extensive tests



RIGID airships, each carrying ten attack bombing planes and capable of ranging thousands of miles from their bases, might be employed effectively by the United States Navy, according to lighter-than-aircraft experts. One type, designed by the Goodyear Tire and Rubber Company, pioneer builders, would have a capacity of 10,000,000 cubic feet of helium, the nonexplosive and nonburning gas of which America has the only large source of supply. It would have a top speed of 84 nautical miles per hour and a cruising speed of 50, more than twice the speed of surface aircraft carriers. This flying carrier would operate in conjunction with other units of the navy, including aircraft carriers. Immune, of course, to submarine attack, the airship would be expected to operate be-

for WARPLANES



Akron class

yond the range of land-based enemy planes and at altitudes above the effective gun range of surface vessels. In case of attack, it would be able to take refuge in the clouds while its own planes streamed out to meet the enemy. It is known that planes can be launched and retrieved by airships because more than 3,000 such operations were made with the airships Akron and Macon a few years back. Launching is accomplished by lowering the plane, attached to a sort of trapeze bar by means of a hook, through a trapdoor. Then, with the plane's motor or motors roaring the pilot releases the hook and the plane drops away. Upon its return to the "mother ship," the plane attaches itself to the trapeze bar by means of the hook as the two fly at virtually equal speeds. Then the plane is drawn into the airship.

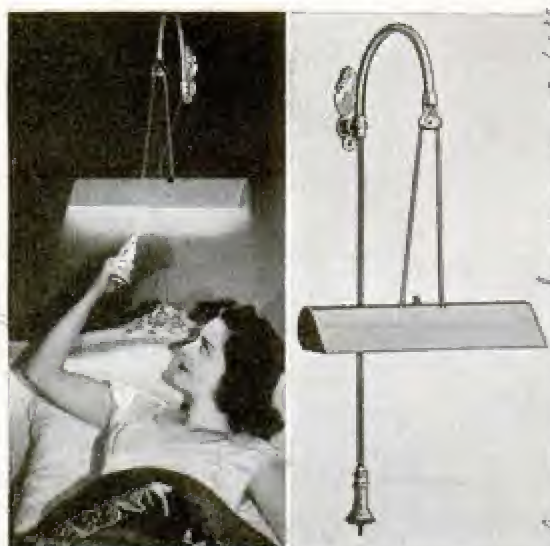
Control cabin as visualized by artist; arrow shows location

Plane just dropping away from the "trapeze bar." Above is trapdoor through which planes are lowered for launching



m 52

Fluorescent Lamp for Wall Adjusts to Any Height



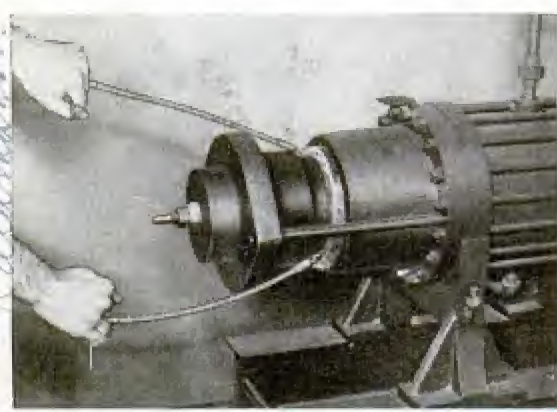
This "daylight" lamp, furnishing a good light for reading, is raised or lowered by moving the cord

Light at any height is afforded by a fluorescent wall lamp just brought out. It has a 14-watt, 15-inch bulb in a reflector. Particularly suitable for a bed lamp, it can be lowered to the best reading level by moving the cord, through which the wire passes to the standard plug.

m 113

Flexible Cable Removes Packing From Difficult Places

Fast removal of packing wedged in hard-to-reach places is possible with a handy hook and flexible cable now on the market. A corkscrew bit at one end of the cable is anchored by turning it into the packing, and a "T" handle at the other end provides a firm grip for pulling. Used in pairs, the



Packing comes out easily with a few tugs on handle of cable which is anchored by a couple of corkscrews

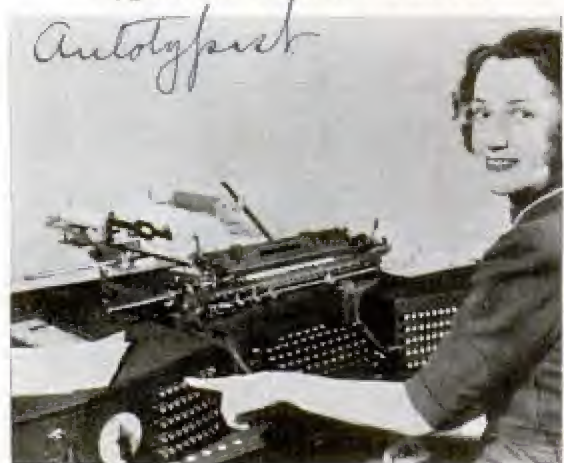
California Detinning Co
o/o Clarence Case, Jr.
tools can be attached at opposite points for speedy action. According to the manufacturer, the cable cannot break when operated by hand.

New Process for Salvaging Tin To Save 40,000 Tons a Year

One California company has undertaken a salvaging program which, utilizing a new detinning process, calls for the recovery of tin from 40,000 tons of tin cans annually. With Malayan tin lost to the Japanese, this process may result in a considerable saving of the vital mineral in the United States. The cans are shredded by a hammer mill and the tin dissolved under pressure with a hot chemical solution. Then the tin is electrolytically deposited an inch thick on iron rolls and later cut and melted into pure tin pigs.

m 122

Automatic "Selector" Typewriter Types the Letter Desired



Pushbutton selects letter or individual paragraph

Any form letter or paragraph can be selected from a specially prepared group and "tuned in" to be written on an automatic typewriter, by pressing one of eighty selector buttons. The machine is actuated by two perforated paper rolls resembling music rolls used in player pianos. Each roll accommodates 200 lines of writing, which may be divided into complete letters, paragraphs, groups of paragraphs, or single-line and multiple-line billing entries. Eighty different selections are possible, and automatic "stops" may be placed anywhere in a paragraph or line permitting the operator to type fill-ins such as names of cities, individuals or products, or dates.

POPULAR MECHANICS

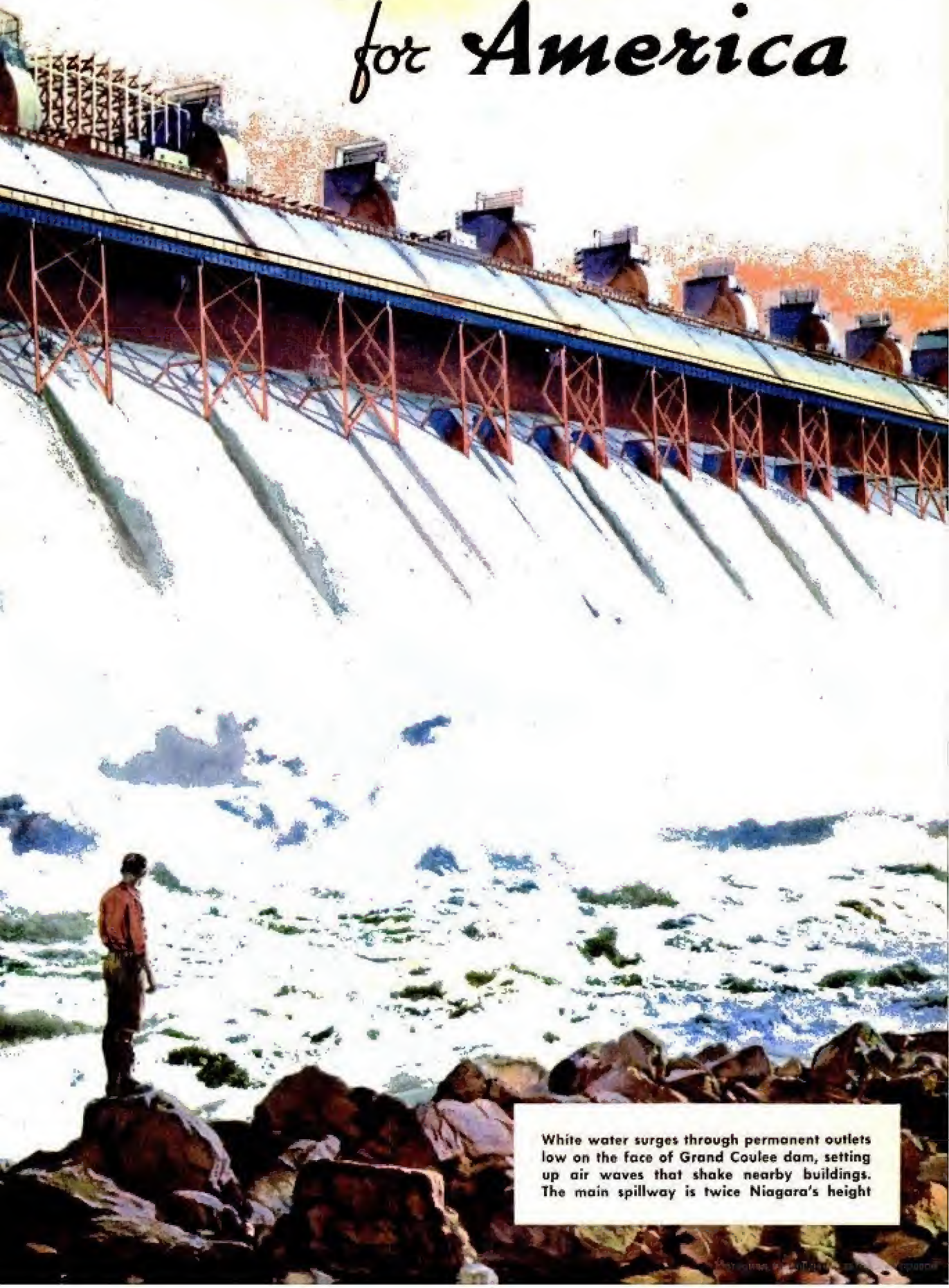
American Automatic
Typewriter Co.

Illustration by the author of the article

L1248

17

More Power for America



White water surges through permanent outlets low on the face of Grand Coulee dam, setting up air waves that shake nearby buildings. The main spillway is twice Niagara's height



18
These huge nuts, used to couple the shaft of the waterwheel to the generator rotor, were shrunk with Dry Ice to 80 degrees below zero so they will expand and tighten after fitting



Rotor for one of the Grand Coulee generators weighs 587 tons and is 31 feet in diameter. Turning at 120 revolutions per minute, the speed of its outer rim is 130 miles an hour



21248
DURING the last few years the United States has tremendously speeded up its program of developing to the utmost the vast water-power resources of the country.

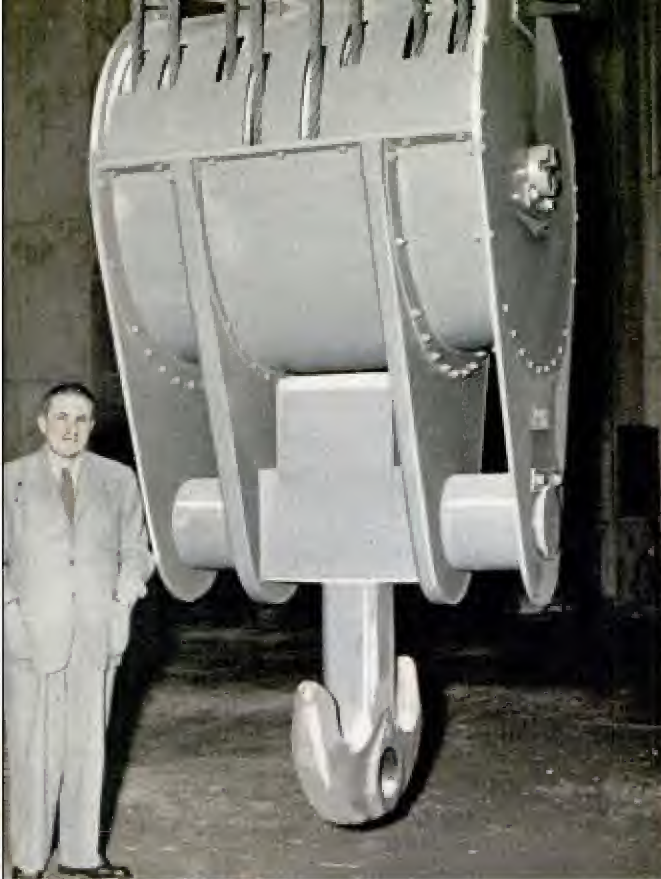
It is a good thing that we did because, suddenly, power in unprecedented amounts is needed to turn the wheels of our great rearmament industries. Ninety-six giant power projects were being completed or were under construction a little more than a year ago.

The most important of these hydroelectric developments, just now going into operation, is contained in the twin powerhouses of Grand Coulee dam in the state of Washington. Here 12,510,000,000 kilowatt-hours of electricity will be generated annually. Eighteen huge generators, driven by water turbines rated at 2,700,000 horsepower, are being installed.

One of these generators alone could illuminate one and a half million 60-watt lamps. Three of them could furnish normal lighting for New York City and Chicago combined. More important today, the output of one generator can produce 100 tons of aluminum a day, equivalent to half a dozen Flying Fortresses or 32 fighter

The human fly at left is measuring the sag of wires from one of more than 2,200 towers on a 450-mile transmission line

Paul Thomas E. Thompson, Jr.
3872 Franklin Ave. Los Angeles



19
This is one of the 175-ton crane hooks used for moving equipment in one of Grand Coulee's powerhouses. In man's most massive structure, everything is built in gigantic scale

L1248

planes. Last year no aluminum was being refined west of the Mississippi; this year one third of the nation's greatly expanded aluminum manufacturing capacity will be located in Washington State, using power extracted from the Columbia river.

Two of the Grand Coulee generators are now in use, a third is being assembled, and three more will go to work during the year. The rest will be installed as fast as they can be built if the demand for power continues.

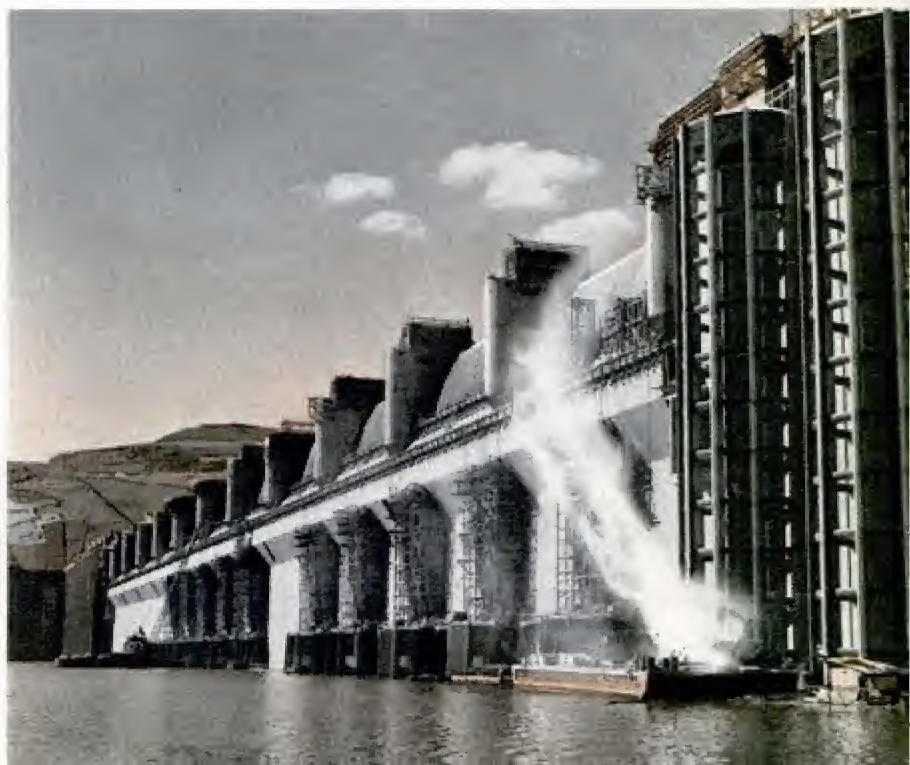
These power units are three stories tall, the largest ever made. Each is costing one and a half million dollars. They are so big that each powerhouse really consists of a number of separate steel and concrete boxes, each containing and support-

View of trash racks and bridge piers during their construction



Here workmen are erecting an electric switching station. Every part of the power line from the dam to Vancouver, Seattle and Tacoma must be fully protected by automatic relays

ing a power unit and separated from its neighbors by cork expansion joints. Stairs and galleries make all parts of each unit accessible, down into the turbine pit where the roar of water rushing past the enclosed blades is too loud for conversation.





20 A section of outlet conduit is moved into its place

Assembling the coils of one of the 274-ton stators



21248 Workman on safety line removes temporary construction material on lower face of the dam

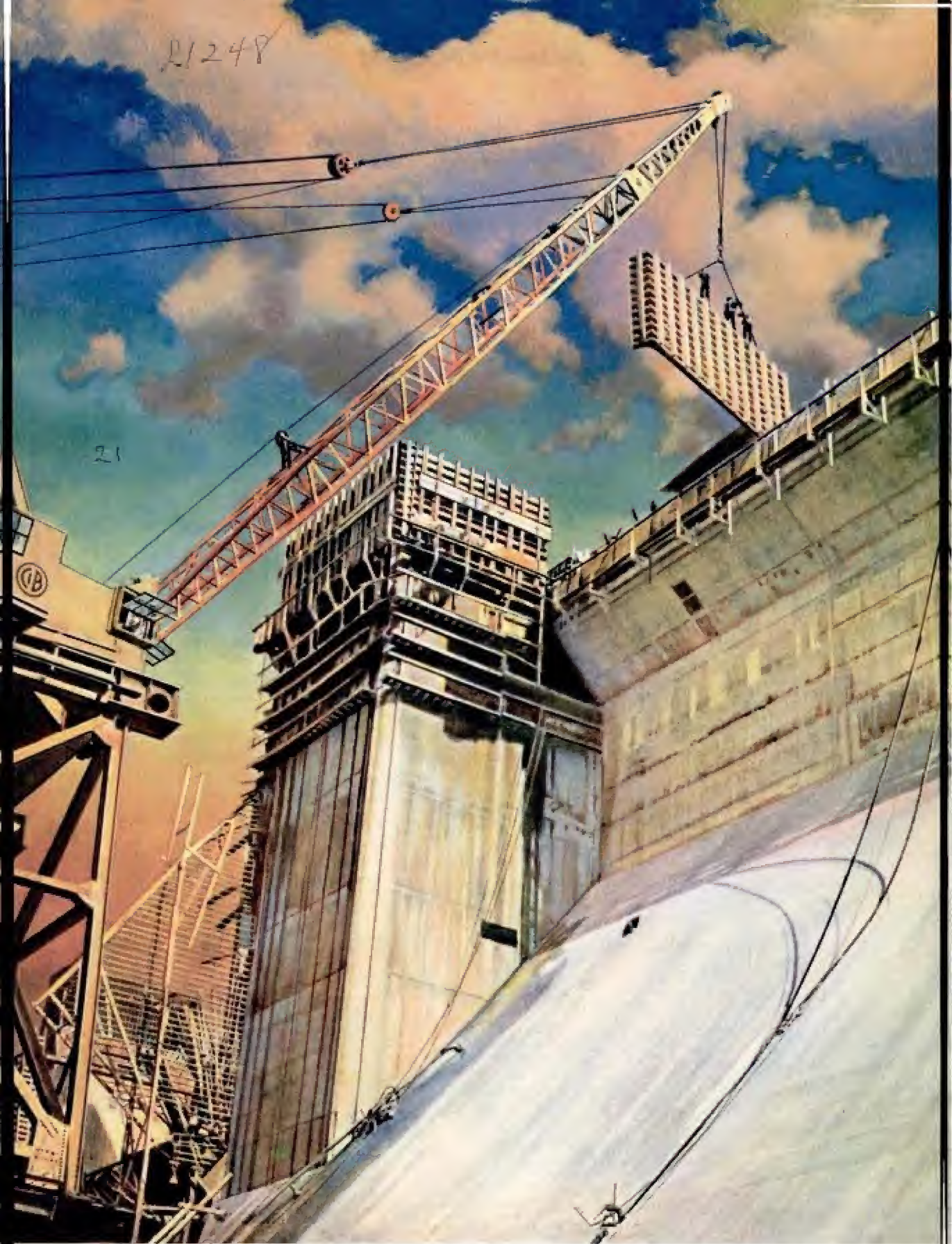
Water from behind the dam flows through a steel penstock tube 18 feet in diameter and enters the turbine at 53 miles per hour. At full load 141 tons of water a second pass through the turbine. The water used by seven of them would supply the whole population with 150 gallons a day.

A steel shaft 44 inches in diameter connects the turbine with the electric generator above it. These power-manufacturing units are Westinghouse 3-phase, 60-cycle, 13,800-volt generators rated at 108,000 kilowatts. Each is enclosed in a housing 45 feet in diameter and is cooled by circulated air. The rotor turns at 120 revolutions per minute and the peripheral speed of its outer rim is 130 miles per hour. The entire rotating assembly, including the water wheel below, weighs 1,000 tons and is suspended from a thrust bearing on top of the generator. The stator frames are 37 feet in diameter and nearly 10 feet tall.

Sturdy as they are, the units were designed with the knowledge that they may need to be taken apart for repairs from time to time. Sections of the shaft that connect the water wheel with the generator are flanged and are joined together with oversize bolts that were temporarily shrunk down to size with Dry Ice when being installed. Holes have been drilled through the bolts so that liquid air can be shot through them to shrink them down again for removal. The entire rotating weight can be brought to a stop from 25 revolutions per minute in 60 seconds by air brakes which, when oil is

21248

21



Here is one of the finishing touches—workmen completing the elevator shaft that will run from top to bottom of the structure. This view of a small area of the dam impresses you with its immensity; within the dimensions of the dam the entire population of the United States could be contained

Ref: S. E. Hutton, director of information
Bureau of Reclamation, Conlee Dam, Wash.

21248

Shail-like scroll case feeds water to turbine waterwheel at 53 miles an hour

lays. If one of the generators should break down, for instance, circuit breakers automatically open, turbine gates shut themselves, and carbon-dioxide gas is immediately released into the generator housing. Annunciators at the control stations show the location of electrical troubles, abnormal temperature changes, and interruptions of oil and water circulation. In addition to its main generators the installation includes three smaller service generators for local power needs.

Ice formation must be guarded against at several points. Water in the lake adjacent to the trash racks behind the dam is kept agitated in cold weather by an air bubbling system using air from compressors inside the dam. If spray from the spillway waterfall forms ice on insulators and conductors in the electrical switchyards above the powerhouses, these circuits can be isolated and shorted to a small generator that heats the system and melts off the ice.

Energy from the generators passes through transformers and is distributed to the Bonneville Power Administration, now finishing a 230,000-volt line to Puget Sound and a 115,000-volt line to Spokane.

substituted for the air, become hydraulic jacks by which the rotating parts can be raised.

Each unit has a local control station where it may be started and stopped, where load and temperatures are indicated, and where voltage and frequency are automatically maintained. An automatic governor on the turbine water gates changes the openings when the turbine speed varies as little as .01 percent. A main control room in each powerhouse is used to distribute loads among the generators, adjust frequencies and voltages, and operate circuit breakers. Every part of the electrical equipment is protected by automatic re-

Another big item is the 16-foot-tall bushing, below, which is to be fitted into one of the transformers

Light on top of Grand Coulee's first completed generator shows the 108,000-kilowatt unit is operating



The 4,300-foot Grand Coulee dam is the largest structure ever built by man. It holds back the Columbia river, second in flow only to the Mississippi, at a point in central Washington where millions of years ago a glacier blocked the river and caused it to cut a temporary channel at right angles to its normal course. The present development project includes a plan eventually to pump flood waters in excess of the Columbia's normal flow up into this old "grand coulee" and from there to distribute it to 1,200,000 acres of rich soil that now lie useless because of inadequate moisture. Power for pumping this water will be available from the billions of kilowatt hours that otherwise would go to waste during summer floods.

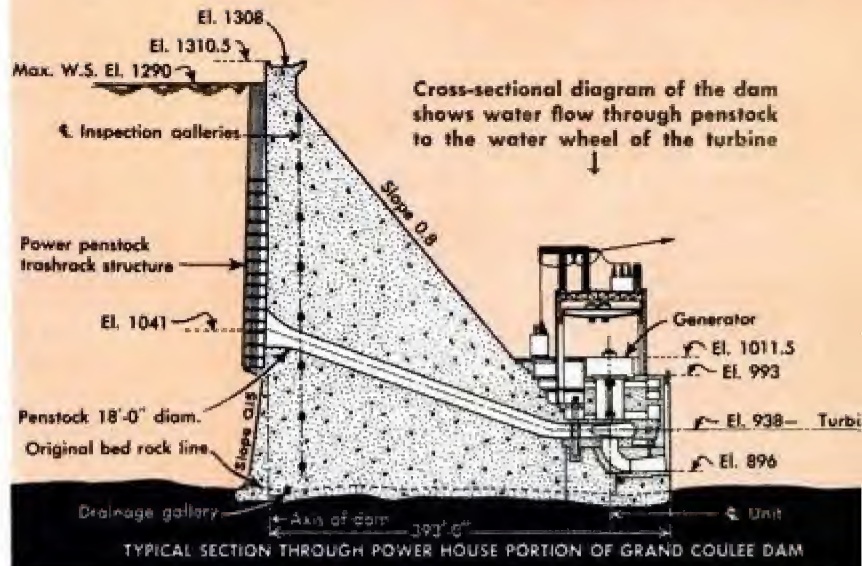
The whole population of the United States could be contained within the dimensions of the dam, so vast is the structure. It weighs twice as much as the nation's people. Its spillway forms a spectacular waterfall twice as high as Niagara. Across the top is a 135-foot highway.

Even when the spillways aren't in use the smaller volume of water cascading from permanent outlet holes lower in the dam sets up air waves powerful enough to vibrate wooden buildings in the vicinity. Erosion below the dam is prevented by a concrete "bucket" or artificial plunge pool at the foot of the spillway that is 90 feet wide and 30 feet deep. The interior of the dam is pierced by 8½ miles of inspection galleries, one of which contains a narrow-gauge railway track.

Right, one of eleven 500-ton drum gates on top of dam, which will divert flood waters over the spillways



↑
Portable X-ray machine rolls into the 18-foot penstock to examine its welded joints for any hidden flaws



L1248



Above, water wheel for one of the 150,000-horsepower turbines. Below, aerial view showing flood waters being released from the lake piling up behind Grand Coulee dam. In foreground a small city has grown up

The dam supports a reservoir 151 miles long containing enough water to supply all of the needs of New York City for a 10-year period. Isolated as it is, the dam is visited by thousands weekly in the tourist season.

As much as possible, completion of the Grand Coulee power facilities as well as of other hydroelectric projects in other parts of the country are being rushed to completion because of the war. All such projects in the west have an additional purpose which eventually will be far more important than that of supplying power alone.

The 11 arid and semiarid western states contain 40 percent of the country's area, only nine percent of its population, and less than five percent of its farmed area. Vast tracts could be devoted to agriculture if only water were available. Already the Bureau of Reclamation has completed three dozen projects in the west by which the scanty rainfall is conserved and made available for irrigation. These projects cost some 250 million dollars but the nearly one million people who have settled on them have already produced a crop wealth of two and a half billion dollars.



24

M 162, Cont. Co. B. Illingman, 504-7th Ave. New York

Air Raid Car Is Packed With Fighting Tools



An ordinary sedan painted white and converted for air-raid use carries all this equipment for emergencies

From a discarded passenger automobile of one of its municipal departments, the city of Troy, N. Y., has created a well-equipped emergency car for use in air raids. Painted white, it has red blinker lights like those of ambulances and police

cars. In the rear seat and trunk and on the roof are packed acetylene torches, steel helmets, water pumps, gas masks, lanterns, ropes, chains, fire extinguishers, ladders, pike poles, battering rams and various other paraphernalia.

M 151

Mirror and Adjustable Target Teach Sighting and Aiming

At Camp Callan, Calif., new recruits are learning to sight a rifle without firing a

shot. With a new aiming and sighting apparatus the target is maneuvered into line

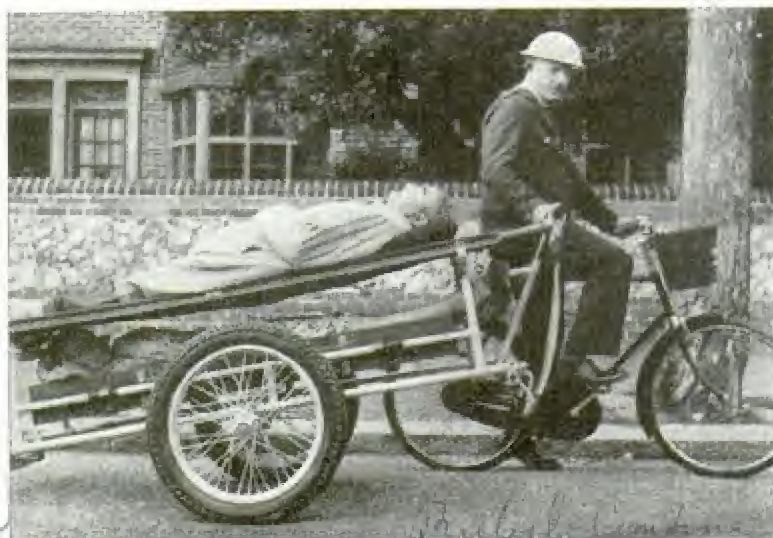
with the sight instead of moving the rifle, which is mounted immovable. The apparatus includes two parallel bars of wood a foot apart, at the far end of which a ten-cent mirror is attached. A circular piece of metal clamped to a wooden slab forms the target. Sighting and aiming are accomplished by adjusting the target until it is in line with the rifle sights as reflected in the mirror. The device is said to be foolproof and does away with hit-or-miss methods which were used formerly.



Recruit adjusts target until its reflection is in line with rifle sights

M-169 by Major J. W. Wasth, England.

Bicyclist Tows Patients on Two-Deck Stretcher



Two bomb victims can be carried to first aid headquarters on a double-deck stretcher designed for air raid work in England. The lightweight tubular metal frame which holds the two stretchers is mounted on a two-wheel dolly and can be towed by a bicyclist.

A British air-raid rescue worker, riding his bicycle, demonstrates how two victims of bombing are towed to hospital on two-deck stretcher

M-174

Trailer Carries Midget Cars in Upper and Lower Tiers

420m Crownoid Trailer Service

Hauling his two midget racing cars from one racetrack to another has been simplified by Duane Carter of Fresno, Calif., by borrowing an idea from the big automobile carriers. He now has a double-deck trailer on which both of the "pint size" racers can be loaded and hauled by his station wagon, which is equipped with sleeping quarters.



Two tracks between ground and floor of trailer make convenient ramp for loading midget racer

M-116

Folding Cradle for Stretchers Makes Any Truck an Ambulance



Archdale G. Jones
Mary O'Riordan

Any light delivery truck or station wagon can be converted instantly into an ambulance by means of a collapsible cradle built to hold two stretchers. Ruggedly constructed of wood and scrap steel, it folds compactly when not in use.

The hinged upper tracks of this cradle will slant downward to facilitate loading of top stretcher in ambulance

Traffic Loudspeaker Helps Guide Pedestrians



London policeman speaks instructions into microphone to help pedestrians cross street in safety

Policemen in Britain have started a new drive against traffic accidents involving pedestrians at busy intersections such as Trafalgar Square in London. A loud-

speaker mounted where it may be heard in all directions and a microphone held in the hand enable a policeman to instruct people how and when to cross the street.

Army's Latest Transport Plane Can Carry "Peep" Cars

Some of the latest technical advances attained by passenger airplane designers will

be included in a new giant military transport ship, when the first Curtiss-Condor C-46 rolls off the assembly line. Following a basic commercial-plane design which would carry 36 passengers and mail, the army plane will carry far more than 36 fully equipped soldiers, and can also carry light artillery and "peep" cars. Two Pratt and Whitney engines will give it a speed about equal to the fastest two-motored bombers.



Fuselage interior of new army plane reveals its enormous proportions

Human hair is used in a new textile fabric for women's dresses, shoes, hats and handbags made in a French factory.

United Photo 27
Photo France
26618756

ARMING CIVILIANS

For DEFENSE



Three dive bombers that have just dropped gas bombs are targets of riflemen training at a British airport

Barbed wire along the shore will impede an invading force but not stop it. Building defenses is a task never finished



Indebtedness is acknowledged to Tom Wintringham, organizer and former commander of Britain's Local Defense Volunteers, from whose book, "New Ways of War," (Penguin Books, New York) much of this article is condensed

DIVE bombers and tanks sweep France into helpless panic, and refugees clog roads that should be carrying armies. Fighting planes swoop down to machine-gun an English village. Armored cars roll through narrow streets of a town in the Ukraine.

Picture yourself in an invaded land. What could you, a civilian, do if your home were threatened?

The two foremost weapons of the blitzkrieg were planes and tanks. In the face of an air attack there are two things to do: keep your head and lie face down—in a hole if possible.

Tom Wintringham, veteran of the world war and the Spanish civil war and organizer of Britain's home guards, says of the plane: "It is a

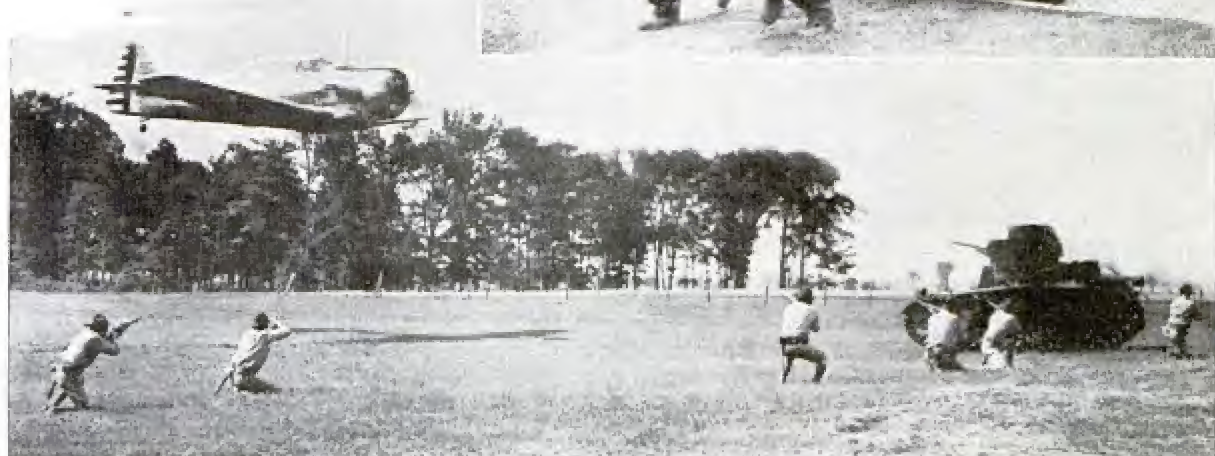
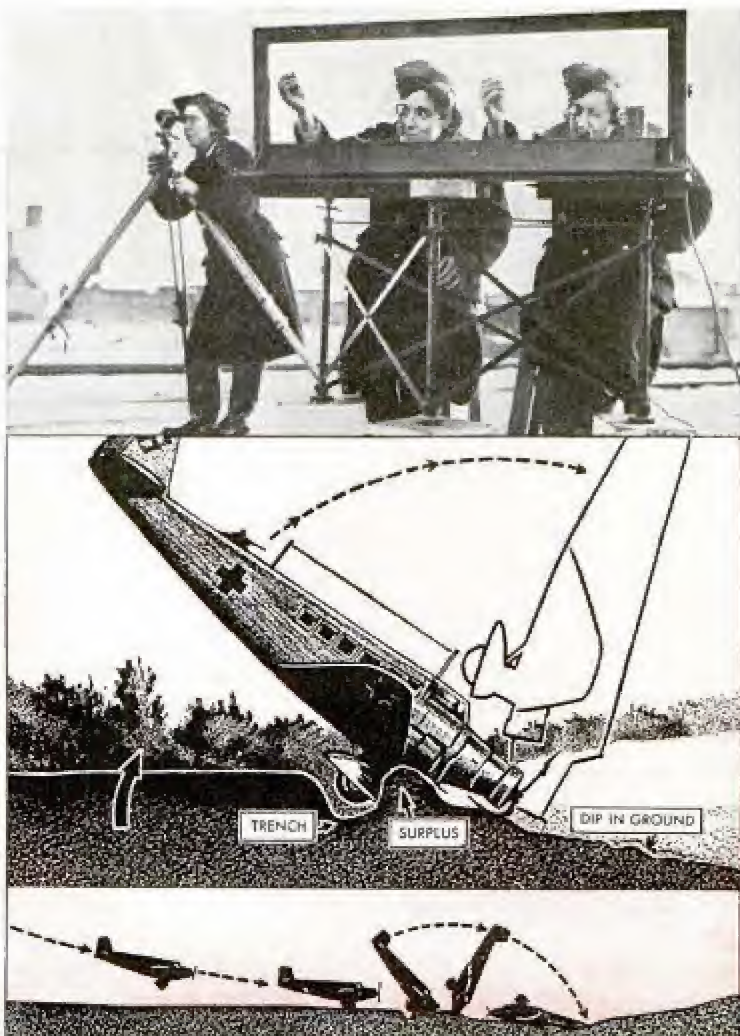
At upper right, English girls learn to spot enemy planes for antiaircraft batteries. Diagram below shows how trench is dug in open field to wreck enemy planes that might land

weapon against morale. It does not in fact kill many men." In his "New Ways of War," written for the English people, he advises:

"Dive bombers are literally the most terrifying things that exist. There is only one thing to do about bombers: stay in a hole and pay attention to your business. Don't look at airplanes. They see faces more easily than anything else. Keep looking where the tanks or the enemy's infantry may appear. Then the bomber is less likely to spot you. Even if he does spot you, he is absolutely unable to hit you except by accident. Troops moving in close formation should scatter as soon as aircraft come over, but should not attempt to reach cover if it is more than 20 to 50 yards away. Break ranks, scatter, lie still, keep faces down."

Bombers cannot capture a country. It is their function to reduce resistance, to wreck fortifications and fac-

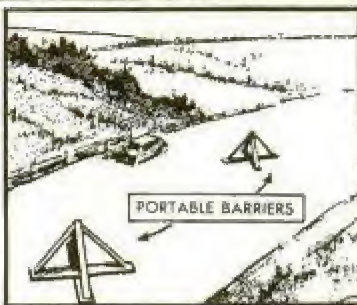
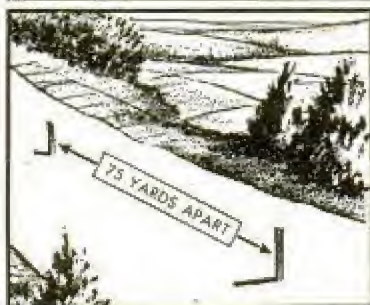
At right, civilian members of London's Auxiliary Fire Service man a trailer fire pump. Below, U. S. Signal Corps photo of plane strafing troops in First Army war maneuvers





Spotters in control tower on British coast watch for signs of invader

Even portable blockades will slow mechanized invasion force and prevent planes from landing, once the road is useless to defending army



tories, to prepare the way for tanks and infantry. The Germans concentrated bombers most heavily where their armored units were held up; therefore, if a road block is to be effective, there must be a trench or dugout nearby where the defenders can hide from aerial bombs and still cover the blockade.

The tank is a formidable weapon, but the miners of Spain found a way to stop Fascist tanks in their civil war. Bringing parcels of explosives from the mines, they hid across the fields, behind trees or shrubs or in ditches. When the tanks came close, one of the miners would fling a packet of explosive, with fuse crackling, between the tank and the ground. And there was no tank! If the tank did not approach close

enough, men on each side would watch the direction the tank's guns were pointing. Bolting from cover on the safe side, one would race in to hurl his hand-made grenade. A tank's gun can seldom turn swiftly enough nor fire at sufficiently steep angle to catch a man crouching beside it.

U. S. Army units have experimented with gasoline bombs for halting tanks. This is simple and effective where the blazing gasoline penetrates into the interior of the tank. But in actual warfare, Wintringham found many a gasoline bomb lobbed on top of a tank would merely warm its roof, and if thrown on the road would splash harmlessly while the speedy tank rolled over it. Grenades containing a pound or pound and a half of explosive, he said, are far more efficient than guns, gasoline bombs or tank

British civilian defense volunteers practice aim on parachuting dummy



471 21403

traps. Most vulnerable parts of a tank are its tracks and cog wheels and, in some, the relatively unarmored underside. A crow-bar thrust at the right spot can disable a tank. Grenades set off by contact are useful. A man hidden in a ditch can haul a grenade across the road with a string just as the tank reaches it. The most dangerous distance from a tank is 200 yards; the safest, six inches.

Motorcycle scouts that usually precede the heavier mechanized units haven't much fire power, and offer good targets even at high speed. One stratagem that slowed Nazi cyclists on the continent was hanging a blanket on a rope across a narrow village street. When a motorcyclist comes up against such an obstacle he stops to find what's beyond; thus halted or slowed, he can be attacked with grenades or guns. Broken glass, or nails hammered through boards, may stop an armored car or cycle.

Every open field is a door ajar for the invader; the defenders must make it impossible for hostile planes to land. Trip wires can be strung across fields, about four feet high. Stout poles can be set in the ground about 50 feet apart, to knock the wings off any plane that attempts to come down. Trenches can be cut, about three feet deep and ten feet wide, one wall vertical and the other sloping, to catch the wheels of a fast-moving airplane.

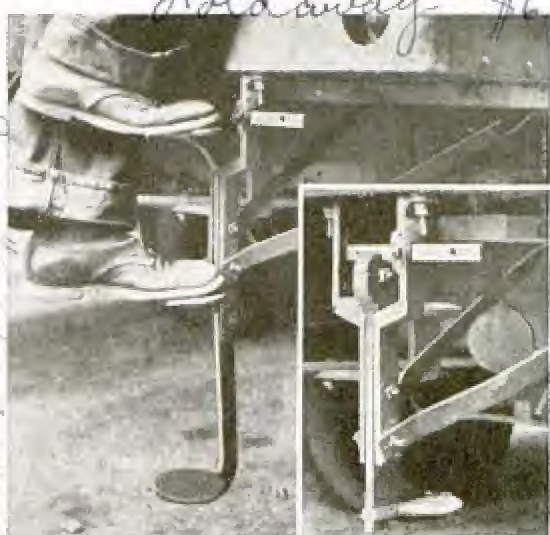
Should actual land invasion of the United States ever occur, it is the hope and intention of the War Department that the Army will handle the situation without being impeded by civilians. In France, refugee traffic interfered with army reinforcements and supplies. Nevertheless American civilians must cooperate in certain phases if war ever comes to this continent—in maintaining order and production, in spotting enemy ships or planes, in enforcing blackouts. And there are some phases of home defense in which America can learn from Europe.

In England orders were given that automobiles not needed for defense units must be immobilized so that a competent enemy mechanic could not make them workable, else the Germans would find all the transport they needed if they captured a few towns. In Poland and France, German tanks drove up to filling stations and took gasoline from the pumps. All stations in an invaded region should be guarded, and

(Continued to page 176)

Steps Folding Under Truck

Save Time and Energy



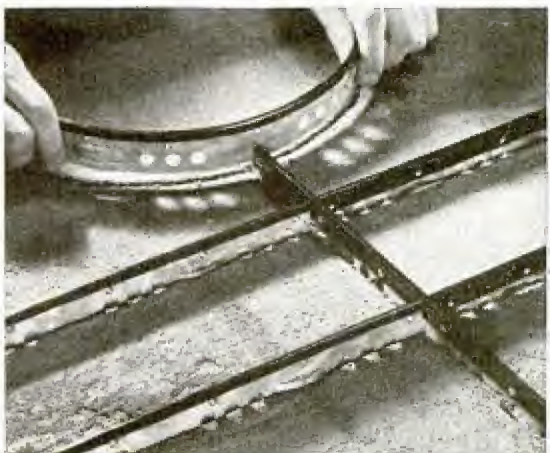
Steps, left, fold under the truck as shown at right

Less effort and time are needed in climbing in and out of a truck equipped with a pivoted step which is fitted with supporting brackets for attaching beneath the truck body. A touch of a lever folds the step out of the way with plenty of road clearance, and the step plates are inverted so snow, ice and dirt do not adhere to them.

Plastic Strips Replace Brass

In Terrazzo Floor Design

Terrazzo floors hereafter may have designs outlined in colorful plastic strips instead of brass, because war production has rendered the metal scarce. As easy to lay as brass, the plastic strips can be formed in large circles, and the material is virtually noninflammable.



Plastic strip forms either circles or straight lines

Pat. 2,250,838

Holdaway \$6.00

2 Martache Inc Co
W. H. vacer, N.Y.C.

m 45

manhattan terrazzo floor
inc. 1915 - 1920
New York City

M130.

Pocket Postal Scale Weighs Letters Up to 2 Ounces

#1.50



Balance scale for letters is carried in leather case

Having no springs, a balance postal-scale weighing letters up to two ounces retains its accuracy after long use. Letters clipped to an arm tilt the dial at the opposite side of the holder, and a pointer indicates the correct weight. Its leather case has two small pockets for stamps.

M100

Cookie Rollers in Three Designs Decorate Pastry Crusts

It is easy to decorate cookies, pie crusts, short breads and candies with artistic de-



Three different designs printed on pastry with rollers

Semirail Corp. New York
132 W. 22nd St.

signs that rival the products of professionals. All you need is a handy baking tool supplied with three interchangeable rollers, each having a different pattern.

M46

Crayons of Known Melting Points Show Temperature of Metal

Welders and other metal workers can now find the approximate temperature of heated metal by marking it with a crayon that fits into a pocket. If a chalk mark appears when the crayon is drawn across it, the metal is colder than the temperature for which that particular piece of crayon is rated. When the rated temperature is reached, the mark melts into a liquid streak. Crayons are supplied to indicate various temperatures at convenient intervals from 125 to 1,600 degrees Fahrenheit.

M149

Ankle Reflectors for Blackouts Help Protect Pedestrians



Ankle reflectors make wearer visible in a blackout

To make pedestrians more visible in a blackout, safety reflectors worn on the ankles have been introduced. Mounted on a strap that encircles the ankle, the reflector catches stray beams of light which can be seen from within a short range.

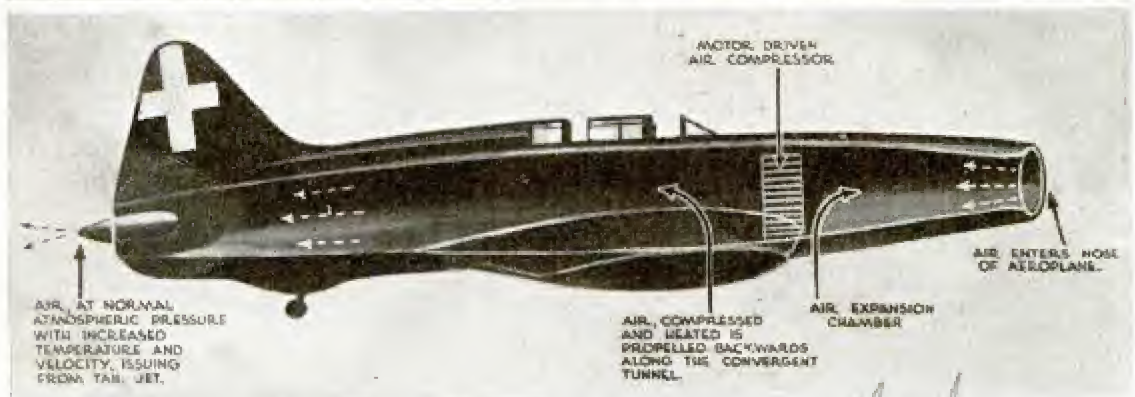
Radio engineers of the British Navy have developed a compact transmitter in a waterproof, buoyant case which is automatically thrown overboard from an abandoned ship to be picked up by survivors, who may then broadcast their position.

See Sec. Eng. Jan
122 Chambers
New York City.

m 80.

Caproni - Campini. C.C. 2.

Airplane Driven by Air Jet Is Developed in Italy



Courtesy "The Aeroplane," England

Top, photo of Italian airplane which is propelled by jet of air. Sketch, bottom, points out details

From Italy comes word that an engineer named Secondo Campini has invented and tested a propellerless airplane driven by a jet of air. The plane draws air into a large duct in its nose, compresses and heats it in a tunnel in the fuselage, and expels the air with great force from a jet in the tail. This

should not be confused with the rocket plane, in which the propelling force is created by the rush of gases from combustion of the fuel itself. In a test flight, the jet-propelled ship is reported to have flown from Milan to Rome in two and a quarter hours, averaging about 130 miles an hour.

Blackout Awning Seals the Window Against Light Leaks

Inconvenience of plunging your home into darkness during a blackout can be averted by installing a metal awning that



Awning open half way, left, and closed for blackout

closes about the window completely and prevents any light from seeping outdoors. Made of rustproof galvanized iron, it guards the window against shattering as a result of explosions or flying bomb fragments. The awning is fireproof, and serves the ordinary purpose of keeping the sun's glare and heat out of the room. An inside lock prevents the entrance of prowlers.

Write to the firms listed in the Where-to-Buy-It index to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

SPORTS SECRETS *in a* FLASH

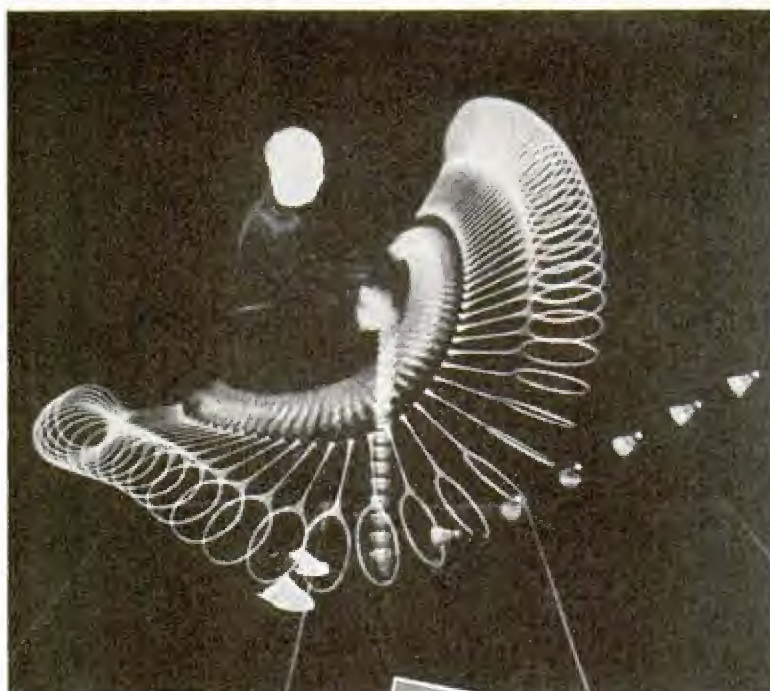
By AUSTIN S. MYERS
and
GEORGE H. TEMPLE, Jr.

Research Laboratory,
A. G. Spalding & Bros., Inc.

Chicago, Ill.
SPORTS equipment is being improved with the aid of high-speed pictures, taken in 1/30,000 second or less, which not only expose faulty design in clubs, rackets and balls but also reveal secrets of form that can be employed to teach both amateur and professional how to play the game better.

For the first time, the basic principles of golf, tennis and other sports are being determined, giving manufacturers a basis for sound scientific design of equipment. One result is a golf club with a properly curved face that straightens out the duffer's drives in an almost miraculous manner. The curved face "bends" toe shots so that they overcome their tendency to hook and corrects heel shots that ordinarily would result in slices.

Super-fast photographs,



Photos © A. G. Spalding & Bros., Inc.

↑
Notice how quickly the bird straightens out in this multi-exposure shot of a beautifully symmetrical badminton service

Despite its effectiveness the baseball pitch seems awkward at this stage, caught by the flash camera in 1/30,000 second →

This view shows device for tripping camera; ordinarily the shot would be made when the ball and bat meet ↓



Multi-exposure of baseball batter taken at 100 exposures per second
Copyright by A. G. Spalding & Bros., Inc.

2211

made by methods worked out by Dr. Harold Edgerton and his associates at Massachusetts Institute of Technology, prove that when a football player like Sid Luckman of the champion Chicago Bears kicks, he actually digs his toe a considerable distance into the ball. How hard the ball is kicked, how much it spins and tumbles after the kick and how a professional player like Luckman does it, also are revealed. Work of this nature results in better football equipment and eventually will act as a foundation for instructional information covering certain phases of the game.

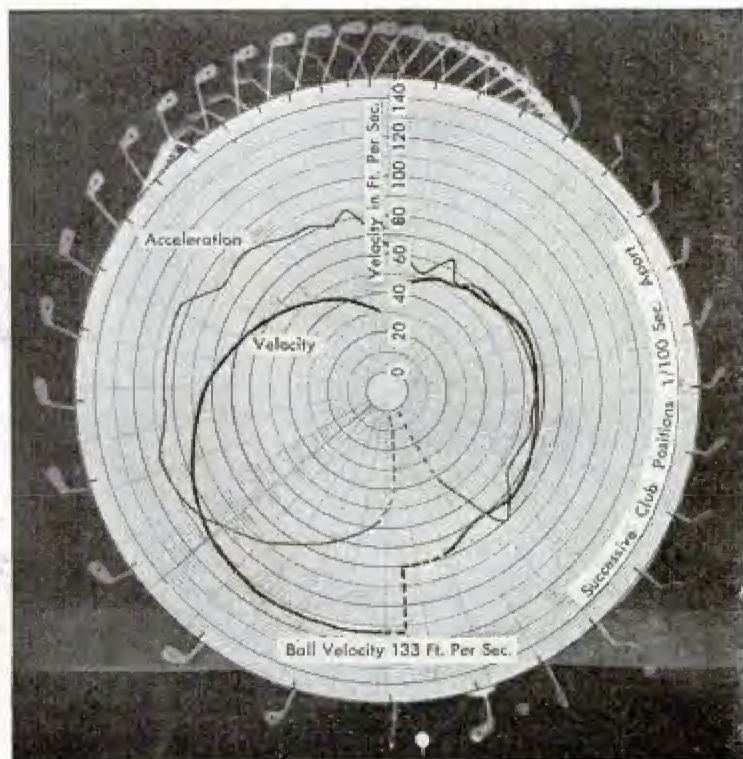
In baseball, the pictures show the bat bending after meeting the ball, the pitcher's arm crooking in an awkward manner midway of the delivery and the ball partly flattening against the bat at the moment of impact. Similarly, a tennis ball flattening against the racket and the racket



Ghost-like is this multi-exposure of basketball player shooting a goal, with position of hand and angle of shot being demonstrated clearly

bending after the impact are exposed by the camera, which also catches odd, sometimes terrifying expressions and gestures characteristic of the individual player in action. Contributing to the manufacturer's information about badminton are flashes of the shuttlecock—the bird—instantly reversing its direction of flight after impact and of the racket bending an appreciable distance.

A. G. Spalding & Bros., through the use of high-speed photography methods, have utilized stroboscopic analysis for studying sports and equipment. The analysis is dependent upon the aid of special electronic circuits and control devices, and special gas-filled discharge tubes. High-speed flash photographs are taken by storing up electrical energy and then, at the time desired, discharging this energy through the gas-filled tubes. These tubes emit a sufficient intensity of light to expose a photographic film in 1/30,000 second, or less, depending upon the



Laid over a multi-exposure photograph, this "Stroke-ometer" chart analyzes golf stroke



Overhead view in 1/30,000 second showing lead of hands happens to catch a shot that was poorly hit

type of electronic circuit used. Photographs have been taken in 3/1,000,000 second. The discharge of the stored electrical energy that produces the light is synchronized with the camera shutter in a manner similar to that for standard flash "guns."

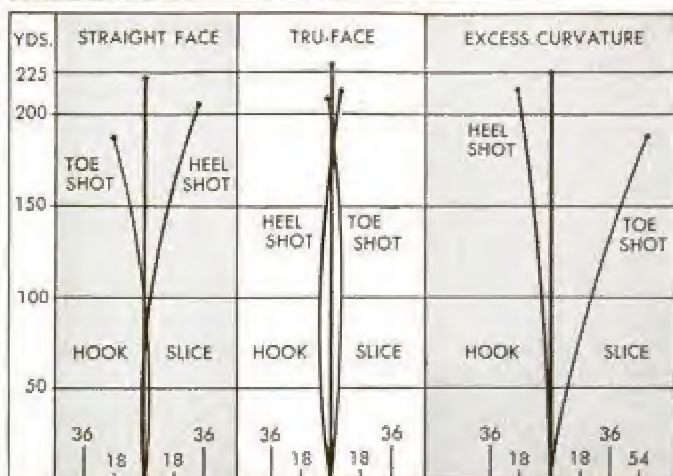
If the discharging of electrical energy through the special tubes is repeated rapidly, the result is a series of intense flashes of light of very short duration, stroboscopic light, that enables one to see several successive positions of a rapidly moving object, such as a golfer driving. Spalding's multiple-exposure photographic technique consists of using a very intense stroboscopic light to record on a single photographic film several images of a single-action sequence. A photo of this type is not an accidental "double exposure," but several intentional exposures on one negative.

By an analysis of multi-exposure photographs, sometimes supplemented by a sequence of single-flash photographs, one

can determine the velocity and acceleration of any moving element, the magnitude of deflections, the magnitude and direction of forces, energy relationships, the rate and amplitude of vibrations, rotational speeds, weight distributions and other factors. Thus are being determined the fundamental principles of various sports.

In making multi-exposure photographs which will not result in a blur of images of the fast-moving player against an over-exposed background, the player wears a black velvet suit and works on and in front of a background of the same material. If a football uniform had been used in pictures of Sid Luckman punting, for instance, it would have photographed as an extreme white because of the intense light and the superimposed body motion; consequently detail of the hands and the ball would have been lost in the white mass of the uniform. The black suit and background result in a ghostlike photograph which shows hands, feet and face of player, and the ball at closely spaced intervals of the action.

Because the physical principles

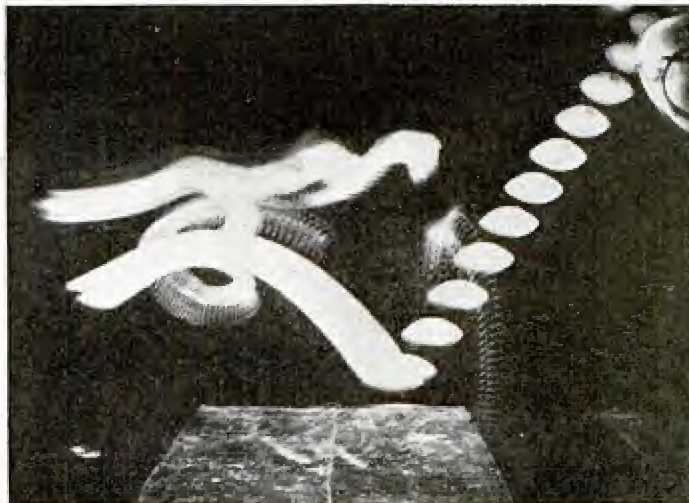


© A. G. Spalding & Bros., Inc.

Photos below compare straight-face club with curved surface of new "Tru-Face" club; diagrams above illustrate effect of clubs on driven ball



m-11



© A. G. Spalding & Bros., Inc.

Single-flash photo in $1/30,000$ second, left, catches impact of place kick; right, multi-exposure of punt

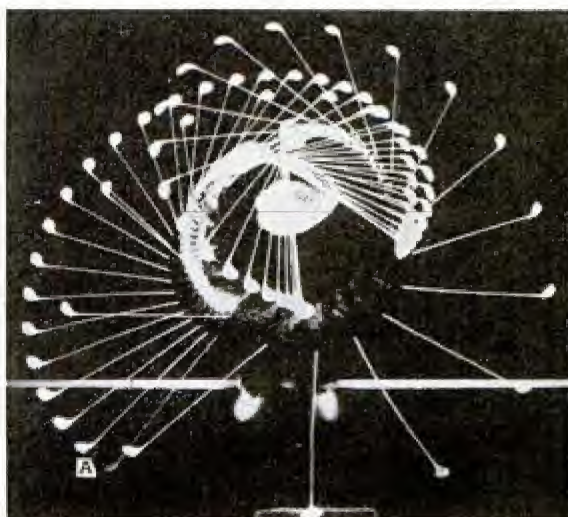
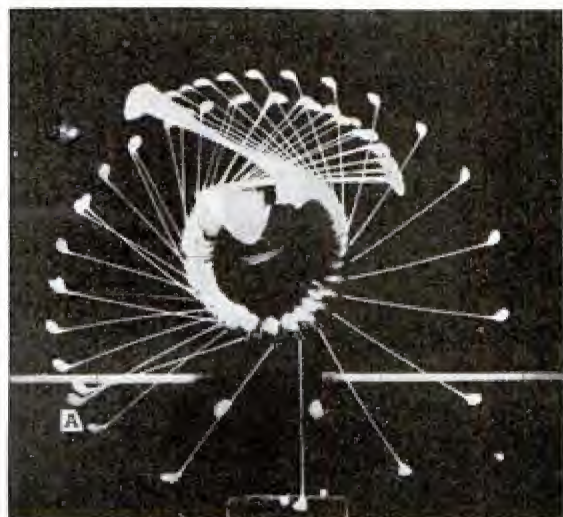
involved in golf are more complex than in most other sports, the Spalding laboratory has worked longer on an analysis of golf equipment than any other sport. What happens when the club face meets the ball in an ordinary drive? In a series of single-flash pictures taken with an exposure time of $3/1,000,000$ second, the initial contact, the flattening and the recoil of the ball from the club face can be clearly seen. Thus it is found that the ball reaches substantially its maximum flattening before its front edge moves forward at all. Similar photographs reveal that club and ball are in contact only .0004 second—certainly not long enough for the golfer to manipulate the ball during impact, as some golfers boast. Another interesting point is that at the moment of impact, an average force of one ton is applied to the ball—just a hint

of the punishment a ball takes every time it is driven. Other valuable clues to the stresses to which the interior of the ball is subjected are uncovered in high speed pictures that reveal how, as the ball is compressed horizontally by the club, its vertical diameter elongates. And, similarly, as the ball reacts from the compression, in leaving the club, the horizontal diameter is stretched and the vertical shortened.

The curved-face golf club, known as the "Tru-Face," with which the duffer may come close to duplicating the long, straight drives of an expert, had its beginning in high-speed photographs. From the pictures, the research engineers were able to observe and measure the gearlike action between the ball and the face of the club which produces sidespin when the contact

(Continued to page 165)

Left, ordinary golfer's swing; right, Bobby Jones's swing. Notice that intervals between club positions in second half of Jones's downswing are greater as uncocking of wrists continually increases club head speed



m 7 v Jack & Tiffany, Ohio

Bubble Boat Hauled on Car Is Inflated by Pump

Barberton, Ohio



Outboard motor may be mounted on special backboard bolted to the frame of "bubble boat"

Upon arrival at beach, the boats are unloaded from top of car and inflated with a tire pump

Jed Connell

Riding the waves on a platter-shaped boat is a new fad offered by Jack Tiffany, inventor, of Youngstown, O. The craft, aptly named a "bubble boat," is a circle of tubing covered with rubberized canvas, which floats when inflated. The canvas contains two air compartments which may be filled by a tire pump. For mounting an outboard motor, a backboard is bolted to the frame of the waferlike boat.



Let's eat this

Holes in All-Plastic Fruit Knife Save Juice While Cutting

Several holes drilled through the blade of a one-piece plastic fruit knife are said to prevent the loss of juice in cutting fruits



Fruit knife made entirely of plastic has several holes in its blade, said to help retain the juice

and vegetables. It peels, slices and cuts all varieties, and its keenness can be restored easily by scraping both sides of the finely serrated edge with an ordinary metal knife. The knife comes in shell pink, crystal clear, Nile green and sapphire blue.

Light Bulbs Use But Five Percent Of Total Electric Energy

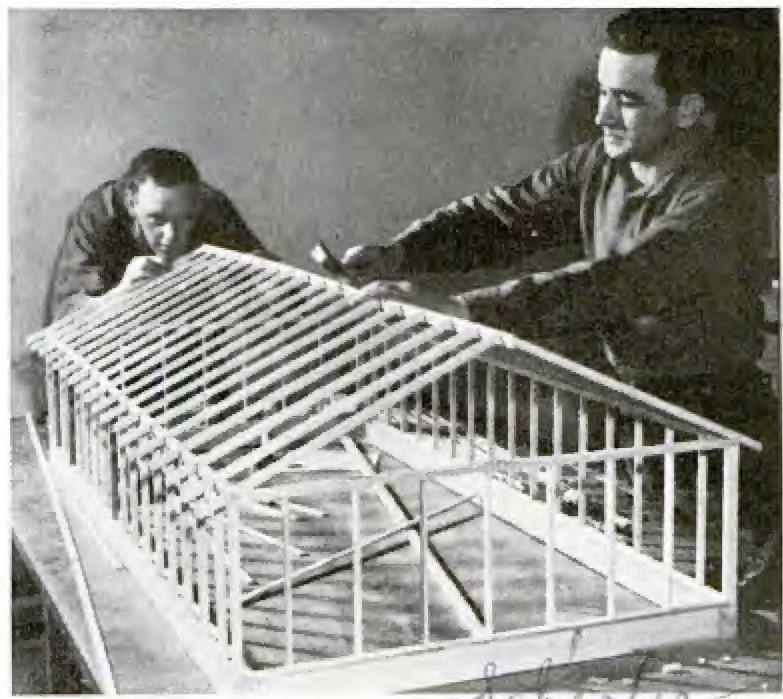
American homes burned up 25,750,000,000 kilowatt hours of electrical energy last year, which was but 18.3 percent of the total of 140,340,000,000 kilowatt hours used for all purposes throughout the nation. The remaining 81.7 percent of electrical power was consumed in industry and transportation. Although the electric light bulb is the most used "appliance" in the home, it takes only a fraction over five per-

420 Lexington Ave
New York City

m 93

cent of the total power, the Edison Electric Institute estimates. After the light bulb, the home appliances consuming most power are the refrigerator (5,645,000,000 kilowatt hours), electric range, water heater, radio, flatiron, oil burner, washing machine, vacuum cleaner, roaster, percolator, toaster, electric clock (193,000,000 kilowatt hours) and ironing machine.

Army Hut Models Help Recruits Learn Camp Construction



Carpenters learning to build army huts erected this model for practice

m 51

Holes Cut in Ladder Top Hold Tools For Workman

Convenient for carpenters and shop workers is a ladder with holes cut in the top step to accommodate various tools. There is a slot shaped for a chisel, another for the hammer, and so on. The tools are always handy and cannot be brushed off.

Small models of army huts, correct in every detail, are being assembled by Canadian Army recruits who are learning construction details of huts for use on camp sites. These men are studying carpentry and woodwork, and their practice with the models will teach them how to solve problems to be faced when they build the real thing.

m 82

Blackout Cane Carries Flashlight Fastened Near Handle

Pedestrians can now light their way during a blackout with a flashlight cane introduced recently. Fitted with a clip like those used on vest-pocket pencils, the flashlight fastens to a leather band near the handle of the cane. Both the flashlight and leather band may be removed readily. Focused downward, the beam projects beyond the tip of the cane, illuminating a small area directly ahead of the feet.

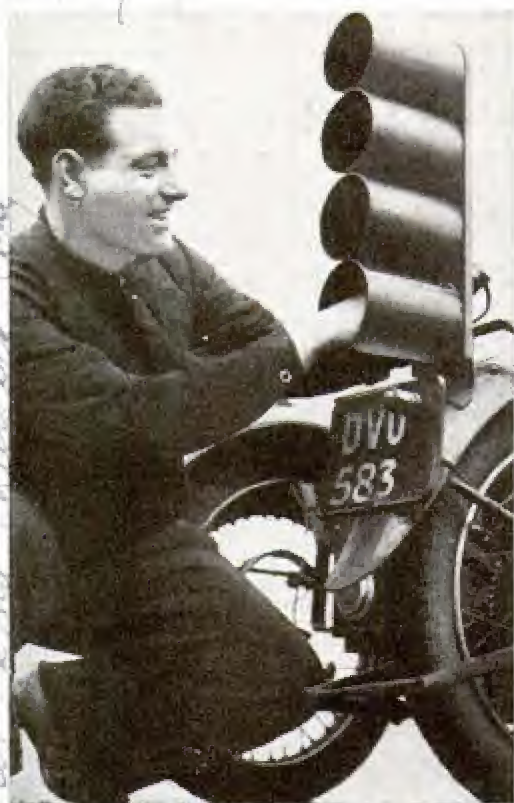


Slots in top of ladder fit the various tools, which are kept from falling and are always in easy reach

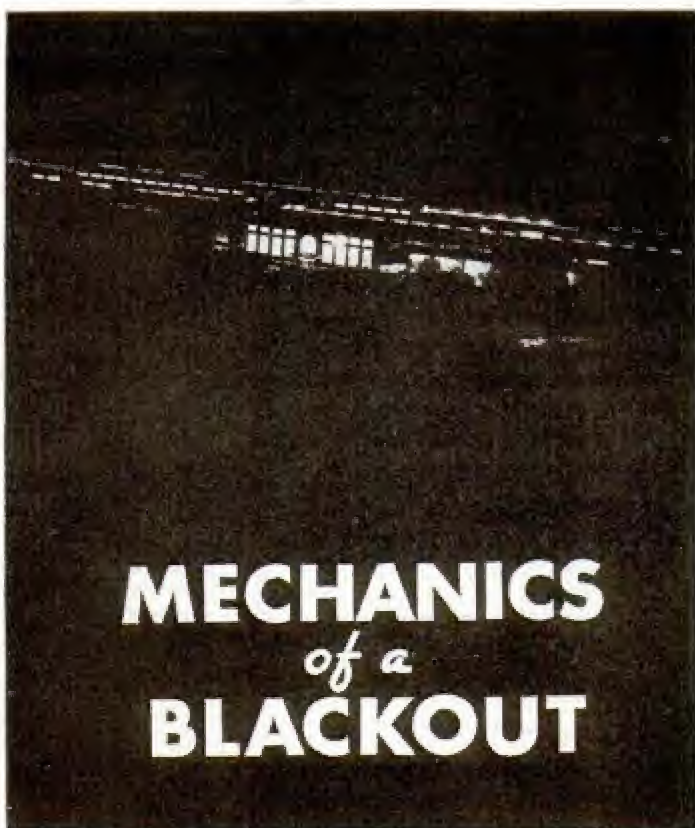
Dist: Ira B. Fry, Merchandise Mart

New York City

Book in Chicago made
understand and 45...



Special shades are fitted over the rear lights of motorcycles used to lead buses and streetcars in Manchester, England, in fog or blackout



MECHANICS of a BLACKOUT

Newark News photo

Here is Newark, N. J., in a blackout test. Only lights permitted were those in the Pennsylvania Railroad station



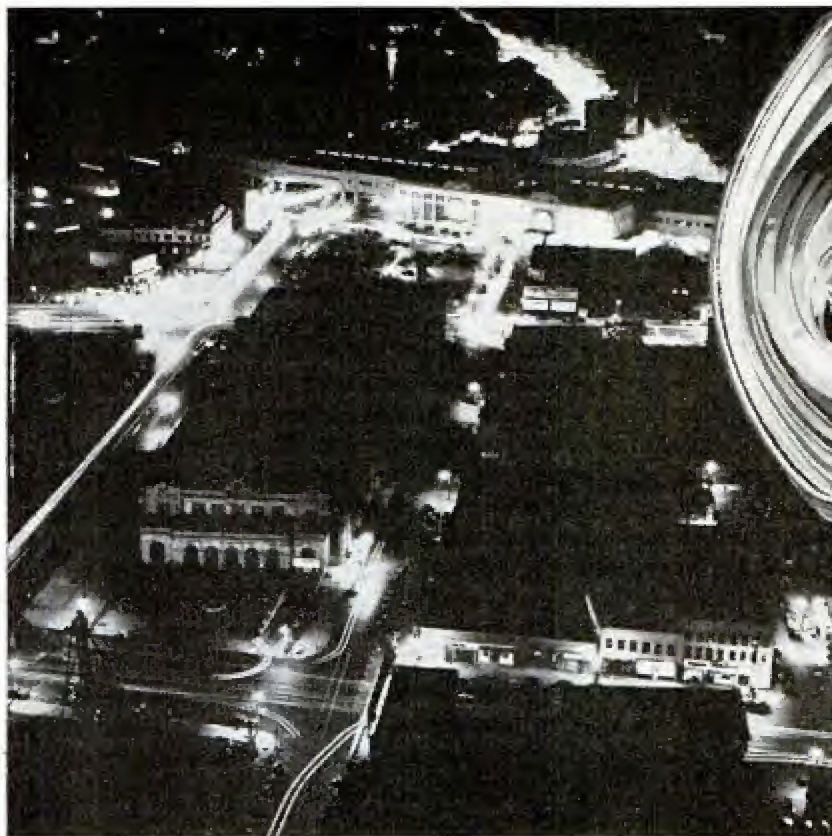
WAILING sirens send shivers down thousands of spines, and a great city swiftly and methodically resolves itself into self-imposed paralysis.

Motorists caught in the blackout pull up to the curb and turn out all lights. Home windows are curtained, skyscrapers suddenly go dark, street cars grind to a halt, flashing neon signs vanish from the skyline one by one, and for a brief moment the only lights visible are the red and green dots of traffic signals. Then they, too, fade into the blackness and there is only an occasional stab of a flashlight or the flicker of a match cupped between hands to light a cigarette.

In the coastal city the blackout is real; farther inland it may be only practice. Anywhere, it is eerie.

At first the public, resentful of a neighbor's careless lights or a brilliant shop window or advertising sign neglected in the night "alert," wondered why you couldn't just pull a master switch in the power station and blacken the entire city.

Touches of white on clothing of pedestrians make them more visible on darkened streets and walks



↑ Low-power argon lamp with "admiral's hat" reflector for street lighting during a "dimout"

← Brightly lighted streets of New-ark as seen just before blackout shown on opposite page

But it is not so easy as that. Alarm systems must not be disrupted by a power cutoff, elevators and electric stoves and heaters need not be. That is the reason for experimental blackouts in interior cities fairly safe from air attack. There must be order in the seeming chaos of darkness.

For the ordinary citizen a blackout involves only inconvenience and a little discomfort. If he is driving his automobile he stops and extinguishes lights. If he is walking he can stumble on in darkness or wait until the lights come on again. If he is at home he simply puts out the lights or blankets the windows. Or he might follow the example of Henry Prescott, paint company executive, who has outlined in luminous paint the tables,



London direction signs were visible at night under large metal shades hiding them from above

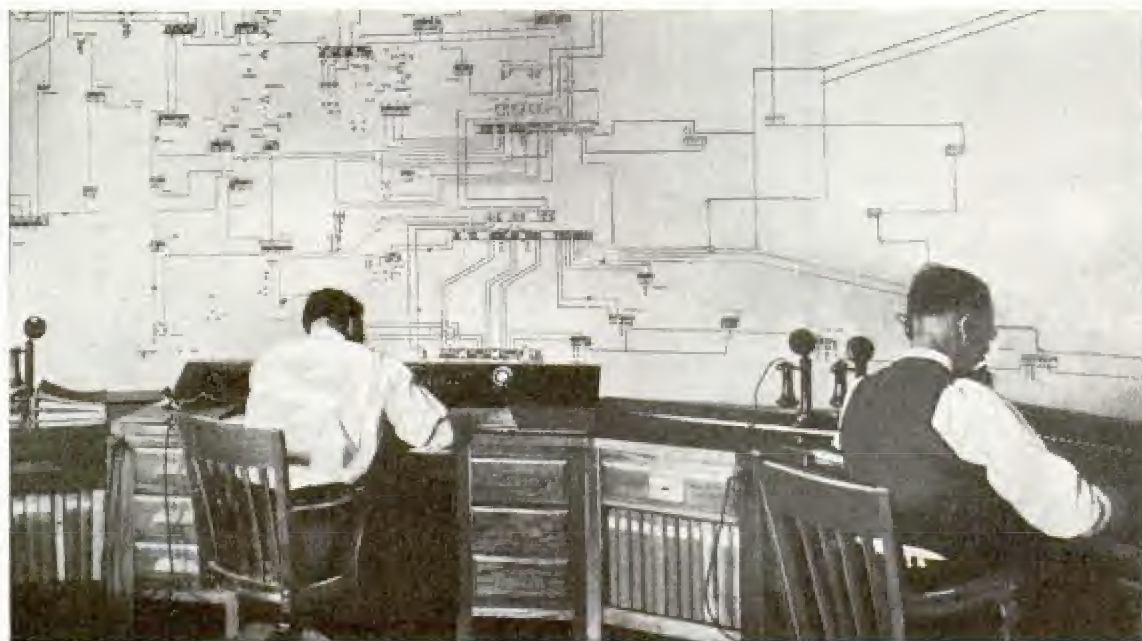


Placing masks over headlights of a fire truck in preparation for a run during a blackout test. Traffic in the blackout is dangerous and nonessential cars must be kept off streets



Operators in a power substation watch rapidly changing indicators of meters as a blackout cuts down the electrical load

As the load on transmission lines drops sharply, engineers in the power company's dispatching office issue necessary orders



chairs and other objects in his Mt. Kisco, N. Y., home. This makes them faintly visible at night when all lights are turned out, and permits most ordinary activities to be continued during the blackout without going to the trouble of curtaining the windows. Luminous paint has been widely used in Europe, but generally on outdoor objects.

The real problems of a blackout are those of police and fire departments, transportation companies, hotels and electric utilities. The life of a big city cannot stop entirely even for a 15-minute period.

Even before the sirens give the "lights out" signal, a load dispatcher at the power house of the electric company is watching the indicator to see how much electrical energy his generators are furnishing to customers. The indicator has been dropping slowly for nearly an hour as people have been turning out lights and going to bed. Then comes the strident wail, warning of danger. Trolleys stop. Lights disappear. The indicator plummets downward.

At Pittsburgh the Duquesne Light Company is said to have dropped about 75,000 kilowatts of electric load when the practice blackout signal sounded. That is

01297
equivalent to about two million ordinary electric lights, more than the total load in many a small city. This load had to be picked up again immediately when the "all clear" sounded. As a matter of fact, the electric load picked up after a blackout is likely to be greater than that dropped at its beginning, as the simultaneous starting of street cars all over the city creates a specially heavy power demand.

This problem is not new to the power companies. They have to handle sudden changes of load in their regular business. The load dropped during a blackout may, in fact, be less than that dropped during the noon-hour shutdown of a working day. Automatic machinery in the power station is designed to take care of such changes. When the load on the generators begins to decline the draft blowers for the boilers automatically slow down and steam supply diminishes. When the load increases the blowers speed up and provide more steam.

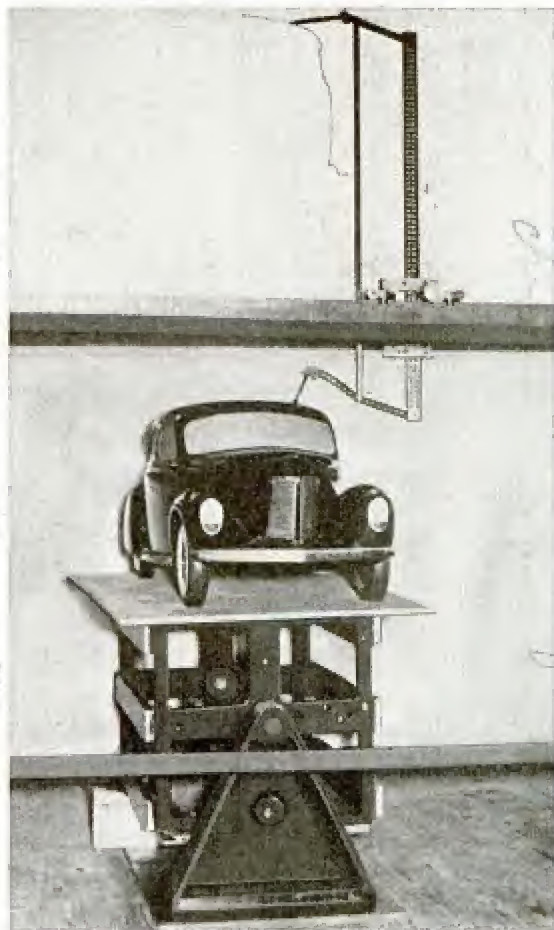
Transportation companies have more difficult problems. Special precautions must be taken to protect the thousands of people riding in the companies' vehicles. During practice blackouts in Seattle, Pittsburgh, Newark and Toronto, all street cars and buses were halted to prevent accidents. But in a protracted blackout the procedure would probably be different, as there would be no way of foretelling the duration of the danger and you can't stop transportation service indefinitely.

In British cities the surface vehicles reduce speed during blackouts, but continue to operate with shaded lights until actual bombing begins. Numerous accidents have occurred as a result of this practice.

Service was halted in Newark's $4\frac{1}{2}$ -mile trolley subway during the trial blackout. Part of this route is under cover, part in an open cut, but the signal lights for both parts are on a single power circuit, and it was decided that the entire signal system should be turned off. This meant that the cars could not continue to operate, even under cover. London's "Underground" keeps running during air raids. Its operation is somewhat hampered by the use of many stations as shelters, but most raids take place at night when travel is relatively light. Whatever might be done in this country about subway operations during an air raid, the use of subway stations as shelters would not be very satisfactory or

(Continued to page 162)

7m49 Track-Riding Drawing Tool Traces Model Outline



Tracing head, following contour of model, actuates drawing pen, at top, which makes sketch of outline

Draftsmen can save themselves considerable work in sketching the exact contour of a model by means of a traveling tracing tool, working like a pantograph, that draws outlines direct from the actual model. It is mounted on a carriage riding an overhead straight track and consists of two movable arms connected by link assembly, one arm extending below the carriage and acting as a tracing head as it moves over the model, while the other, extending upward, contains a tracing pen or scribe and draws outlines to conform with the motions of the tracing head. The equipment is portable and may be used in drafting rooms and template departments. It is handy also for checking cavities on casting dies.

Look in the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

Helmet Holds Field Glasses Leaving Hands Free



Resting on the platform extending from metal headgear, the field glasses are held steady at eye level

To hold field glasses at eye level while leaving the hands free for other tasks an inventor has brought out a semi-helmet, consisting of metal straps fitting over the head, an extension to support the glasses, and a chin strap. It is adjustable by wing nuts. The inventor believes the mount would be of value in military operations.

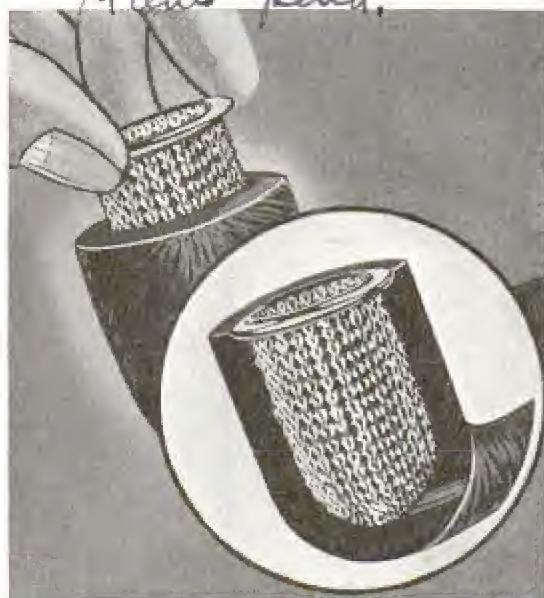
Man Power of Warring Nations Estimated Near 200,000,000

Based on their man power of military age, the Allied nations outnumber the Axis better than five to one. This is the estimate made by the U. S. Census Bureau, which puts the total of men aged 18 to 35 in the United States, Great Britain and its Dominions, Russia and China at 163,887,000 against a total of 28,560,000 available to Germany, Italy and Japan. These figures did not include the Netherlands Indies, where adequate census records are lacking, but the Indies have a total male and female population of more than 69,000,000. Further, the German-occupied countries stretching from Norway and France to Poland and Greece, and French Indo-China, are omitted from the Axis side of

the balance sheet, and they have a total population of 167,978,000. Males of military age are estimated by the Census Bureau as follows: United States, Philippines and other territories and possessions, 22,796,000; United Kingdom, 6,815,000; Australia, 1,083,000; Canada, 1,797,000; New Zealand except native Maoris, 238,000; Union of South Africa whites, 340,000; India, 58,244,000; Russia, 23,574,000; China, 49,000,000. Against these are ranged Germany, including Austria and Sudetenland but not other occupied lands, 11,281,000; Italy, 6,440,000; Japan, without Korea and Manchukuo, 10,839,000.

Glass Filter for Tobacco Pipe Sweetens and Cools Smoke

Many complaints of pipe smokers are said to be overcome with a glass-fabric filter that fits like a bag inside the bowl. With the filter installed, there is no need for breaking in a new pipe, since the Fiberglass lining acts as a ready-made cake until a sweet, even cake has been formed. It also insulates and cools the bowl. The glass mesh strains the smoke, keeps tobacco particles out of the shank, prevents clogging and reduces the need for using pipe-cleaners and reamers. Like a wick, it carries the harsh and bitter juices to the combustion zone where they burn off, keeping the pipe dry and doing away with tongue bite. It prevents waste by burning the tobacco to a white ash on a cushion of air cells.



Inserting filter made of glass fabric into bowl of pipe. Sketch in circle shows lining formed by bag

POPULAR MECHANICS

785

(K. H. Jackson, supervisor)

Phone System in Helmets Helps Teach Welding



Left, apprentice and instructor using one-way phone; helmets, right, reveal receiver and transmitter

Protection for the arc-welding instructor and greater efficiency in teaching are provided by hooking up a one-way telephone between helmets worn by the teacher and student. Using two ordinary helmets, an instructor at Caterpillar Tractor company of Peoria, Ill., installed a transmitter in the one worn by himself, and a receiver in the one for the apprentice. The outside wires, connected to a wall box

containing four "B" batteries, are strung through ring supports overhead to keep them out of the way. This arrangement permits the teacher to give instructions while the apprentice works, such as telling him to shorten or lengthen his arc or commenting on the rate of travel, all in an ordinary tone quite audible to the student. The instructor often can point out things impossible to illustrate in the classroom.

Allen Warr-Elbert
3435 32nd
Cmt.

Extra Tanks of Nazi Planes Resemble Huge Torpedoes

When the British 8th Army captured an airport in the Libyan desert they found a great pile of tanks resembling huge torpedoes. Apparently these were auxiliary fuel tanks brought across the Mediterranean to furnish additional supplies for the German air forces.



British soldier examines the torpedolike fuel tanks captured in desert

Write to the firms listed in the Where-to-Buy-It index, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

TIPS *for* TABLE TOPPERS



It has been said that three things make table-top photography an ideal pastime. First, it's a lot of fun; second, it teaches you how to create subjects and exercise your imagination; and, third, it makes you master of lighting effects—the interesting ones—in record time. So let's go table-topping. It has its basis in the little everyday objects of life—the tiny ornaments, the toys—which we often overlook. It took two flood lamps, some pipe cleaners, an alarm clock and a big slice of imagination to create the snapshot at top, right. If you have a little porcelain dragon, you can set it on a table, arrange a few tiny Chinese figures as desired and then shoot something resembling the picture shown below. Its creator used two No. 1 flood lamps—one three feet back and slightly to the right, and above the subject, the second, farther away and behind the camera



Above are two interesting table-topping photos, the top one illustrating the preparation of a scene, the bottom one showing the resulting picture. The deer is just a porcelain figure, the snow nothing colder than salt shown being applied to create the winter landscape in the photo at top. Of course, much of the punch in table-top photos is supplied by the lighting. It's easy to achieve desirable lighting effects even with simple equipment, because you're working on a small scale. One No. 1 and one No. 2 flood lamps in inexpensive handy reflectors are usually sufficient, but you may find use for a small spotlight if you go table-topping in a big way





This might be labeled "Old Woman Who Lived in a Shoe Had So Many Children—." One secret of the successful table-topper lies in his skillful arrangement of scenes, as demonstrated at left. These and other pictures on these two pages should give you a good idea of what kind of subjects may be used. If you find nothing at home to excite your imagination, a trip to the toy counter of your dime store may prove worth while. That toy counter is not only a source of materials, but ideas as well.

At right is something a little different, but merely a football "made up" for a striking photograph. Common objects appear quite different in closeups. As a result, if you like realism in your table-tops, you can achieve the effect of snow by substituting sugar, salt or cotton; of water with a piece of rippled glass, crumpled wrapping material, or a mirror; of a lawn or pasture with a bit of plain, dark carpet; of a tree with a small branch or a few leaves. You can make funny little figures and animals from vegetables, pipe cleaners, bits of cloth and wire, toothpicks and whatnot. From the technical standpoint, you'll do best to use a small lens aperture to obtain all-over sharpness, and to keep the background close to foreground. Furthermore, when working at close range, you should aim the camera lens rather than the viewfinder directly at the subject.



Heaviest Bomb to Fall on Britain Weighs Nearly Two Tons



Giant bomb is probably the heaviest to be released on Britain

One of the heaviest bombs the Nazi air force has used against Britain is a giant, nicknamed "Satan," which failed to explode. It weighs 3,968 pounds, a few pounds less than two tons. The fins of this dud were broken off when it struck, but originally it measured 13 feet 3 inches in length, and 2 feet 3 inches in diameter.

Ban on Cameras in Civil Planes For Duration of War

Aerial photographs by civilians are forbidden "for the duration" by a War Department order. Passengers on air liners are required to pack their cameras beyond reach or check them with the stewardess, and the ban also extends to crews of the air liners. No civilian can carry a camera in his own plane; even the Civil Air Patrol, composed of civilian pilots operating under army orders, is forbidden to take pictures from the sky. There is but one loophole. A civilian having a highly important reason for taking an aerial photograph can

petition the regional office of the Civil Aeronautics Administration, which must pass the request on to the War and Navy Departments. But permits from Washington are expected to be rare.

Air Cleaner Deodorizes 100 Cubic Feet a Minute

Working on the principle of a gas mask, an electrically operated "adsorber" purifies kitchen air at the rate of 100 cubic feet per minute. It removes cooking odors so quickly that onions and other odorous dishes may be prepared without fear of offending the most discriminating guest. In the purification process, air is drawn by a fan through a filter and then through tiny grains of carbon produced from coconut shells. The surface of each grain consists of countless microscopic canals or capillaries which adsorb impurities such as condensable gases and vapors which carry the odors. When the carbon becomes saturated with impurities it may be reactivated and used many times over. This is the same process used in military gas masks. The adsorber is housed in a streamline container 24 inches long. A 40-watt motor turns the fan.



"Adsorber" operates like gas mask in deodorizing air

m12? The Pacific Lumber Co.

Fiber From Redwood Bark Is Wool Substitute

Now they're harvesting wool for clothing from the bark of California's giant redwood trees, oldest living things on earth. Until a decade ago this bark, which grows up to ten inches thick, was a waste product. Then research men of the Pacific Lumber company discovered the bark fibers had valuable insulating properties; they were long-lived, resisted fire and moisture, and were distasteful to vermin and insects. Redwood wool insulates cold storage and meat packing plants, quick-freeze food warehouses and the walls and ceilings of homes. The latest development is its use in textiles. Combined with natural sheep wool, the bark fibers form a strong fabric, useful in felt hats, lightweight blankets and clothing. The combinations range from 15 to 60 percent of bark fiber in the finished products.

Fibre a.

Patio insulation



100% Wool. It's a new fabric.



↑ Here is a jacket made partly of fibers from redwood bark. In her hands the young lady holds redwood wool sample

← Stripping the bark from a giant redwood log. It is shredded and processed into textile fibers and wool for insulation

New War Tools Are Built From Old by Yankee Ingenuity

Changing over industrial plants from peace to war production has been speeded up mightily by Yankee ingenuity in improvising tools for the new purposes rather than waiting for specially built machinery. One factory, for example, switched production from electric fans and motors to gun turrets and shell boosters. It would have taken two months to get a new machine to burr holes inside the shell boosters, but in 30 hours the engineers rigged up a homemade machine to do the job—

making use of a dentist's burr. It took them 60 hours to build a machine that would ream two holes simultaneously. The superintendent used a fan base and a couple of pieces of machine tool to contrive a machine that would check the accuracy of threads on the shell boosters. An old standard arbor press was converted into an air-operated machine to stake screws in the shell boosters, and a girl who formerly worked on a machine making loose-leaf notebook binders is operating it.

BILLIONS WAITING to be TAKEN



Grappling with the nine-foot arms of the diving bell at bottom of the sea

Below, talking by phone from deck of salvage vessel to diver on sea floor



By Lieut. Harry E. Rieseberg

Noted deep sea explorer and salvage expert, and author of "I Hunt Treasure," (Robert H. McBride Co., publishers) from which this story has been condensed

SOME DAY, when peace returns to the oceans, we'll start prying open Davy Jones's locker to wrest from it the fabulous treasure sealed there under shifting sands and barnacles, guarded by treacherous deep-sea fish and octopus and the enormous pressure of the depths.

Billions lie there awaiting the challenge of brave and resourceful men; billions in pirate gold and merchant cargo lost in storm and battle. Since 1500, one-eighth of all the gold and silver mined by men

has been sunk to the ocean's bottom. A former chief of the Navy hydrographic office reported that in 1893 "reliable statistics show an average annual loss of 2,172 ships in the commerce of the world." Multiply that by 100 and the total of ships sunk in the 19th century alone is staggering.

Twenty-five million tons of shipping went down in World War I, and the toll in the present war will be even more disastrous. But the public fancy turns most often to those argosies of the 16th, 17th and

see August 1934
212.

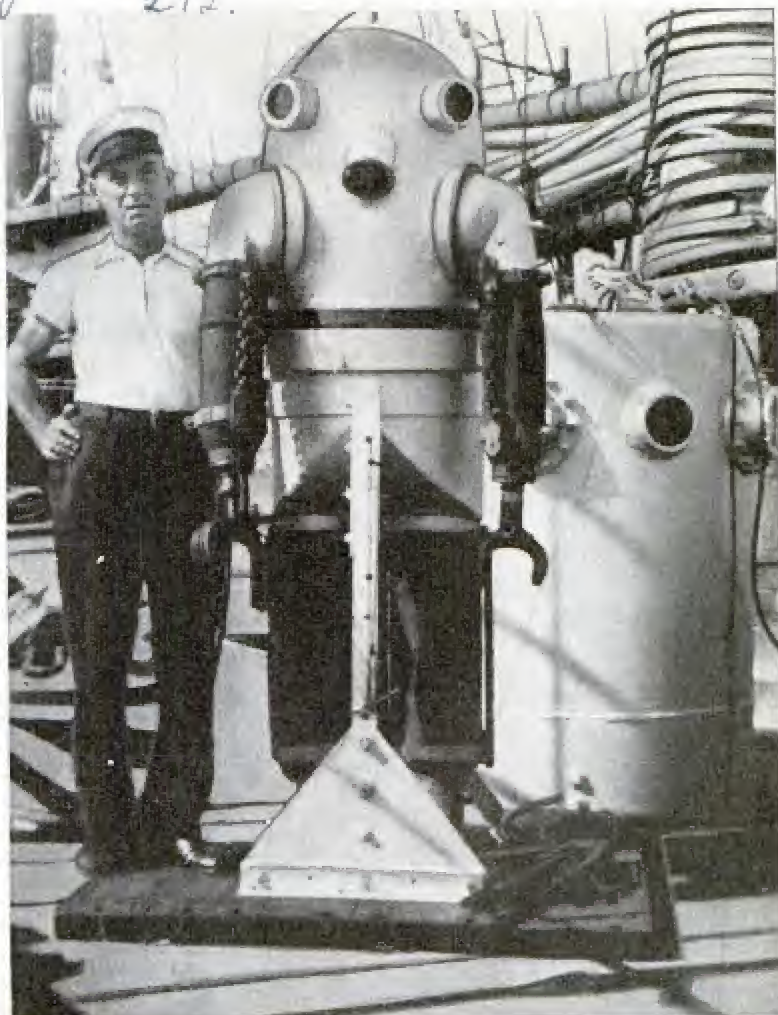
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18th centuries that loaded gold and silver and gems in the new world for Spain and Portugal, only to founder or be looted by pirates in the Caribbean.

Some economists estimate the world's drowned treasure at \$3,000,000,000, and this takes in only such wealth as gold and silver, jewels and ornaments. In merchant cargo and ships themselves the value would be far higher. According to authentic records of the 16th century, the Portuguese and Spanish alone were relieved of more than \$250,000,000 in treasure. The first major catastrophe of that century was suffered by Spain in 1502. Three years before, Francisco de Bobadilla had been appointed Governor of all Hispaniola by King Ferdinand and Queen Isabella. Bobadilla had come from Spain with this commission, and, jealous of Christopher Columbus, soon trumped up a charge against him. Columbus was chained and sent back to Madrid to be tried for disloyalty.

With Columbus out of the way, Bobadilla began gathering for himself a fortune in gold and silver and ordered his henchmen to stop at no means in forcing the Indian and

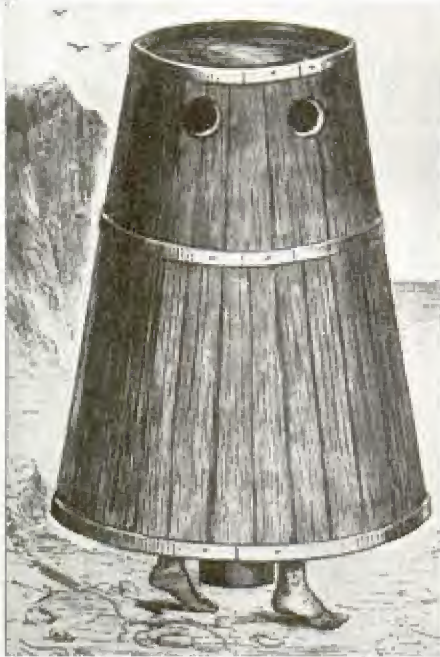


© Lieut. H. E. Rieseberg

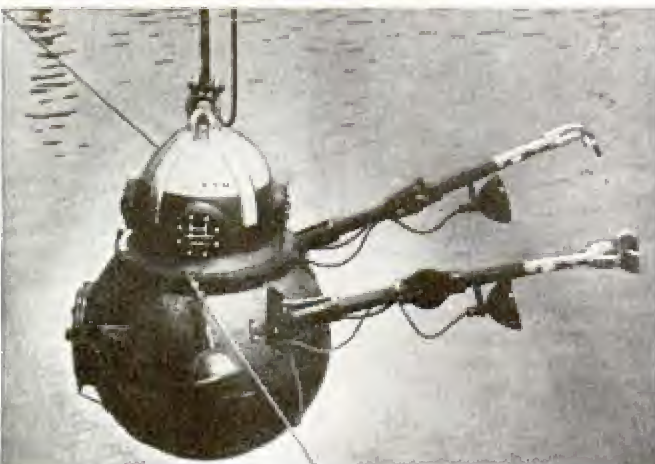
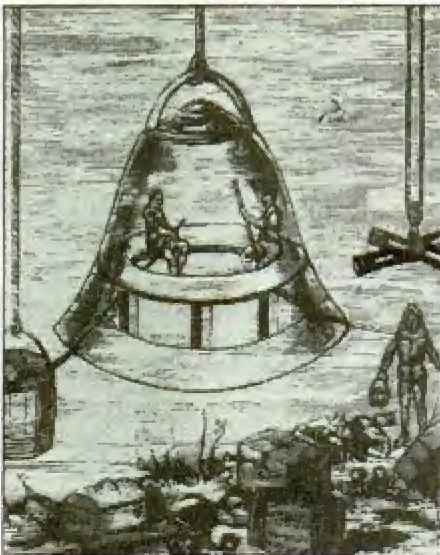
Weird and clumsy "iron man" is safe for descents of 1,000 to 1,500 feet

Clad in heavy wool clothing, Lieutenant Rieseberg enters the diving bell





These are 17th century diving bells; in the one below fresh air is being siphoned into open-bottom bell from lowered barrel



← Modern deep-sea robot is lowered away



Negro slaves to produce the coveted metals. The fiendish methods adopted have made an eternal black mark in history. Three years later Bobadilla stowed his tremendous accumulation of gold and silver aboard his flagship, the "Golden Hinde," and all was in readiness to sail for Spain when into Santo Domingo harbor sailed the lead ship of an inward bound fleet. Christopher Columbus, no longer in chains, was aboard! Columbus sent word to the flagship that bad weather was imminent, but Bobadilla scoffed at the warning, and his "Golden Hinde" swept out of the harbor July 4, 1502.

The "Golden Hinde" never reached Spain. A hurricane swept across the Caribbean, and the galleon plunged to her doom near Cape Engano, Haiti. There she lies, weighted down with more than \$5,000,000 in golden ingots and silver plate, awaiting some lucky salvor.

The Portuguese suffered even greater losses in that century. Dutch privateers plundered the Portuguese galleons laden with gold from Brazilian placer mines. The Portuguese scuttled their craft rather than lose the treasure to the Dutch and today, the shoreline of Brazil is marked with the hulks of those treasure-laden ships.

In the 17th century, one of Spain's greatest losses was the \$21,000,000 Silver Shoals treasure; another was the destruction of a fleet of galleons laden with \$30,000,000 treasure by the Dutch Admiral Pietr Heyn, off the coast of Cuba.

The Silver Shoals loss was due to shipwreck on those treacherous reefs in 1643. In 1687, a New England skipper recovered some \$1,500,000—from one of the rotting hulks. The balance is unsalvaged.

In 1628, Admiral Heyn received word that a Spanish fleet was about to sail homeward. Heyn slipped into a Cuban bay and waited. On September 8 he sighted the flotilla and saluted it with a devastating broadside and



© Lieut. H. E. Rieseberg

Stars mark major treasure caches on Caribbean map

In the diving suit is the author, internationally known salvage expert and authority on ocean treasure

chased four galleons and eleven other craft into the shelter of Matanzas Bay, where the Spanish hoped to land the treasure and hide it in the jungle. There was no time. The Dutch frigates were coming. Frantically the Spaniards heaved the precious cargo into the waters of Matanzas Bay, set fire to their galleons—and consigned \$30,000,000 to the sea. It's still there.

For sheer bulk of treasure no story can compete with the disaster that overtook the Spanish at Vigo Bay in 1702. It concerns 17 galleons packed with \$140,000,000—the greatest plate fleet in history! As France and Spain were allied, a French escort was dispatched to bring to Europe the treasure galleons. There were 40 ships in the fleet—17 galleons and 23 French warships.

When the news reached England, Queen Anne dispatched 27 frigates to head off the galleons. The Spaniards and French ran for Vigo Bay, on the northwest coast of Spain. They arrived ahead of the British, threw a boom of chains and topmasts across the harbor mouth and took every

(Continued to page 178)



Opaque Shade for Blackout Stops Leakage of Light



Blackout shade fits snugly so light cannot escape

Blackout roller shades designed for home use operate in the normal way and do not interfere with shades already in place. "Hold-down" brackets keep the drawn shade tightly pressed against the sides and sill of the window frame, preventing light from seeping outdoors. Made of heavy, washable, opaque material, the shades are available in 36-by-84 inch size, 42-by-92 and 42-by-96.

Corkscrew Combined With Puller Removes Cork Gently

Only slight physical effort is needed in pulling tight-set corks with a corkscrew built into a wooden screw-type puller. In



Cork puller lifts corks gradually and without jerk

operation, the corkscrew is turned into the cork its full length in the usual manner. Then the second handle is turned in the same direction until the wooden shell bears against the top of the bottle. A few more easy turns will exert an upward pull upon the cork, bringing it out unbroken.

Fireproof, Rot-Resistant Wood Replaces Steel and Concrete

Lumber impregnated with chemical salts to preserve it against decay is taking the place of steel and concrete as a building material. "Preserved" wood has long been used by railroads for bridge timbers and ties, and now that steel is in demand for war purposes, treated wood is finding far wider uses. It is termite repellent, clean, odorless and easily painted. One preservative, chromated zinc chloride, also gives wood substantial resistance to fire.

Dispensing Cup on Bottle Top Pours Amount Desired

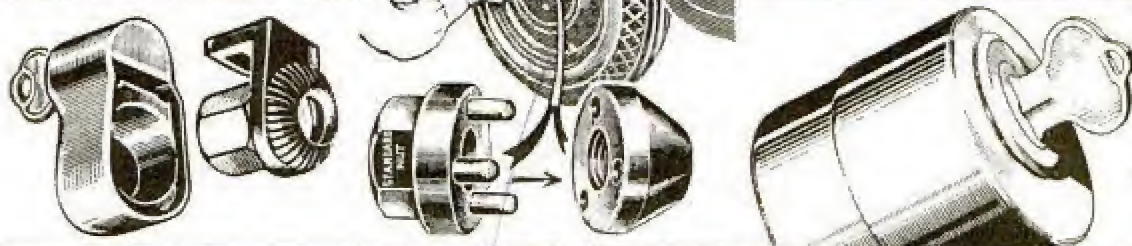
Liquids can be served in controlled amounts from a bottle fitted with a dispenser which permits you to see the portion before emptying it into a glass. If too



Pressing plunger releases liquid from the dispenser

much flows into the dispenser it may be poured back into the bottle and remeasured. A thumb lever lifts a plunger to release the liquid from the dispenser. This action also seals the bottle so no more liquid can be poured in one serving than had been permitted to enter the cup. Fitting most bottles by means of a rubber collar, the dispenser quickly serves fruit juices, salad dressings and other liquids without risk of an overdose.

Branding Iron and Lug Locks Foil Tire Thief



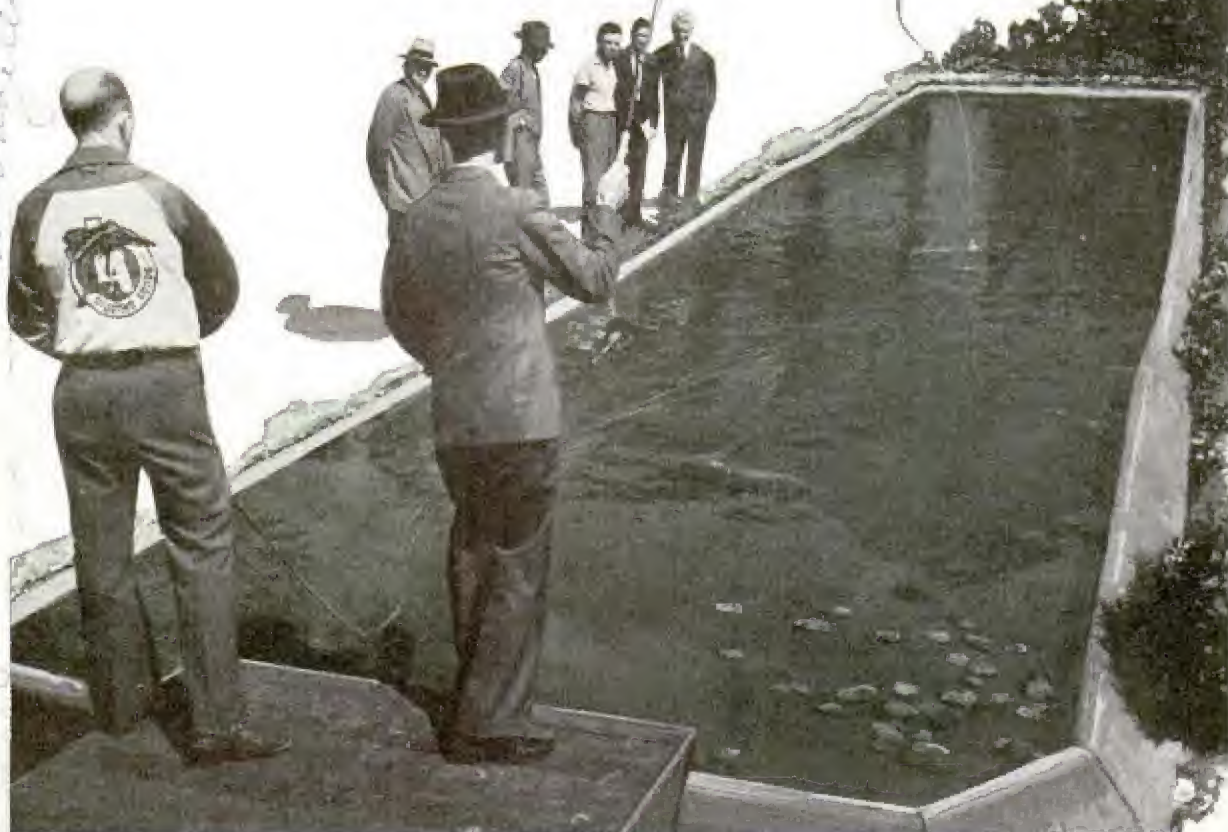
Left, top and bottom, tire is branded with initials and license number. At top, center and right, serial number of tire is traced with pencil and filed for identification. Other pictures show various lug locks

With tires now in the category of precious possessions, motorists are taking new precautions to prevent theft and to recover tires that are stolen. A record of serial numbers is essential for the identification of stolen tires, and this can be obtained easily, even if the numbers are on the inner side of the tire, by laying a sheet of paper over them and rubbing a pencil or crayon over the paper until the numbers are transferred in clear relief. Your initials or license number can be branded on each tire with an electric branding iron without damaging the casing. This service is offered by some rubber companies and ga-

rages. Another method of foiling the tire thief is to install one of the several types of lug nut locks that are available. Fastened tightly over at least one lug on each wheel, these locks make it impossible to remove the lug without first forcing the lock, which is a tough job and difficult to achieve without attracting attention. The lock weighs four to eight ounces, and should be counterbalanced by a mechanic to keep the wheel in proper balance for maximum driving ease and tire mileage.

(To learn where to buy commercial products described in these pages, see the index.

HOW *to* OUTSMART *the* FISH



Fly fishermen, practicing for accuracy, try to drop fly within wooden ring floating on the water

Photos Automobile Club of Southern California

Taking water temperature. The colder it is, the more fish hug the bottom and must be fished for deeply

By C. B. Harrison

Fishing Expert, Automobile Club of Southern California



NINETY percent of the people who go fishing don't know how to fish. They go where there are no fish, or scare them away, or fish improperly. If you follow a few simple rules, you'll catch fish and have fun besides.

First of all, don't be too proud to ask questions. Resort owners and the hardware and tackle-store men know where the fish are and what sort of lures they are taking. Ask them.

Some spots in every stream and lake are better than others. Often the best way to fish one lake is a poor way to fish another. There's



Fast water like this is the place to fish for the hard-hitting trout

Various plugs and lures. Curved plug at right attracts by churning water



one chain of three lakes, almost side by side and fed by the same stream, that takes bait fishing in the upper lake, fly casting in the middle lake, and deep trolling in the third for best results. Different water conditions and feed account for this. If you can't find fish in a strange lake by looking for them, trolling will often reveal the best spots.

Bass, trout, crappie, perch, catfish and bluegill and other sunfish are the most popular fresh water fish. Most of them can be caught on either bait, spinners, flies, or plugs, and there is a time and place for each of these lures. When you are away from home it's smart to buy baits and lures locally from people who know what the fish are taking.

Fish bite whenever they are hungry and they are least active in the middle of the day. That's about all you need to remem-

ber. There are a lot of rules to the effect that fish won't bite during or after thunderstorms or on windy days or on a falling barometer but all these rules fail. You are apt to catch fish any time so the time to go fishing is whenever you feel like it. Not everyone will agree with me about this but such arguments are among the things that make fishing interesting.

A good fisherman makes a careful, quiet approach to the spot that he hopes to fish. He watches for fish and tries to see on what they are feeding. If none are active he looks for them among the rocks and among grass and branches. Generally he uses a bait or spinner early in the season and changes to a fly when warm weather heats the water and brings the fish up to the surface. Bugs and flies hatch out on the surface of the water in warm weather and the fish rise to this feed.



Clawlike mechanical holder is being used here instead of landing net to take the catch. Be sure to take one of them when you go fishing

The good fisherman uses the lightest leader and smallest hook that are practical because they will catch more fish than heavy equipment that the fish may see. He remembers that fish are timid. Vibrations caused when you stumble over a rock or when you row a boat carelessly will scare fish away. Chunking a bait or fly into the water with a splash will frighten them. So does your shadow on the water, or active movements if you are standing against the sky. Try to stand with your back to the sun, far enough back from the water so that your shadow is on the bank. If you can stay hidden behind a rock or tree there's not a chance for the fish to see you.

The man who wades or works upstream, throwing his lure ahead of him and letting it drift back, usually catches more fish than the man who works downstream. This is because fish normally keep their heads pointed upstream into the current and are less apt to see a fisherman approaching from behind.

Seventy percent of the fish that are caught are taken on bait, either natural or artificial. If you carry worms on

the trip, don't drown them with water. Damp earth is better for them than moist earth. And don't keep them on the floor of the car right above the exhaust pipe. Too much heat will kill them.

If you are using bait in a stream, let the current drift it along just as if it were another piece of debris or food on its way downstream. Fishing with bait in a lake, let the bait lie on the bottom if the bottom is sandy. On a mossy bottom the bait must be held a few inches above the moss so that fish can see it. If the bottom is weedy the bait must rest higher still, being held in

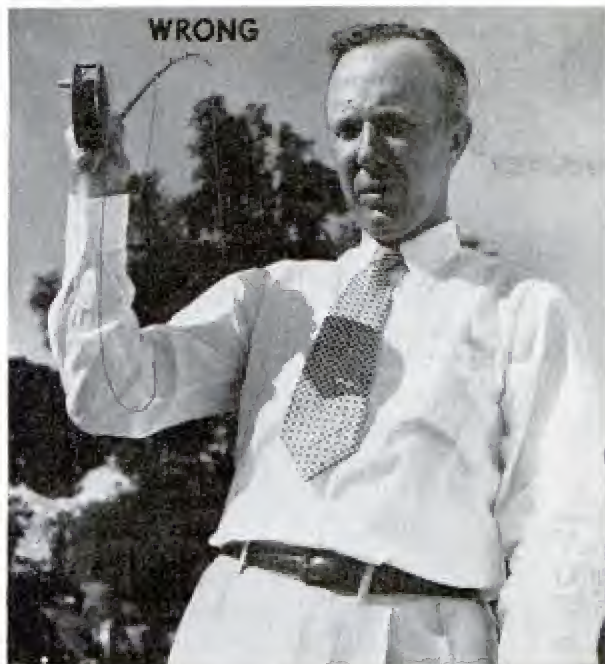
place with a float. Bait fishing requires patience and you will catch few fish if you jerk the hook every time you feel a nibble. Unless you are working in a fast stream you must let the fish take the bait and start away with it before you set the hook.

Good fly casting is an art and the best way to learn it is to ask a good fly fisherman to teach you. He will be able to get 50 or 60 feet of line out and then drop the fly gently on the water. Half that amount of line will catch a lot of fish if you don't slap the water with the fly, so forget about trying to make long distance casts until you learn to make good short ones. A

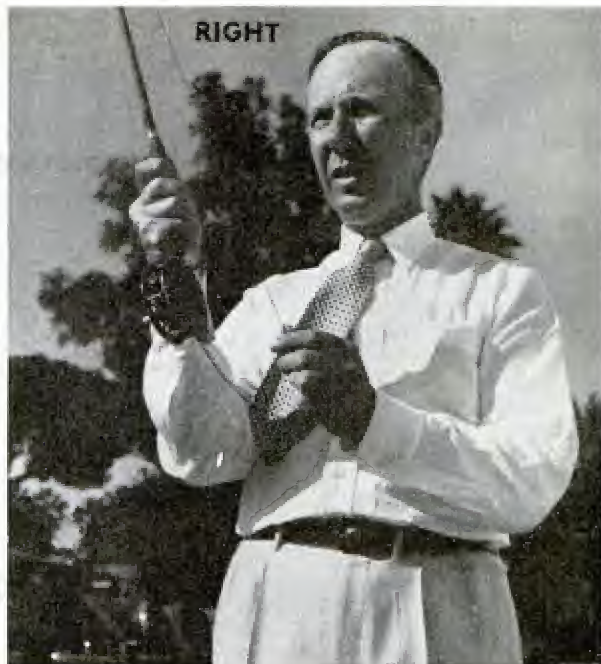


Quiet and caution, fishing still waters in weeds and rushes, help in catching fish

2993



Raising upper arm, moving arm away from body and flipping rod too far back are three mistakes commonly made in fly casting



In contrast, note this position, which is top of back cast. Wait a second, then shoot line forward with short snap of the wrist

cheap rod is not much good for fly casting.

Forget that you have a shoulder and an upper arm in making casts and use only the forearm and wrist. Toss the line up behind you with a short sharp flick of the wrist, wait a second for it to begin to straighten out, and bring it ahead again with a forward wrist motion. A good fly caster puts a little "kick" in the forward motion that lays the line out straight and drops the fly gently. Don't try to control the line; learn to control the rod and it will control the line. After you have learned the fundamentals you can practice casting on your lawn.

Fish that take a fly usually hit it hard and fast so always watch the fly when it is on the water. Hit back instantly but not too hard the instant you see a fish hit. Sometimes when fish won't rise to a fly you can get action by hooking a short length of worm to the barb and letting it stream out behind the fly.

Big fish like deep water and they like to hide beneath undercut stream banks. From a lake bank, toss your lure out past the drop-off

to reach the edge of deep water. On a stream, throw the lure so the current will drift it down toward the undercut bank.

There are literally hundreds of artificial lures on the market. Some of them resemble natural baits and some of them look like nothing on earth. Most of them do a



Fish holder built like elongated landing net attached to side of boat for keeping captured fish alive



Trying out the "action" of a wobbling bass plug in test tank. Anglers should know how each lure and plug works in water. Angler in swordfishing cap which keeps sun off his face is shown selecting a rubber crawfish to be used as bass lure.



good job but you should use local advice in making a selection. One of the best varieties of these lures is the so-called flat fish of different sizes. These are light wooden plugs that are carved on a curve, the effect of this being that they set up a violent action when being retrieved through the water.

You can spend \$100 on a fishing outfit or you may buy everything you need for less than \$10. A complete and inexpensive outfit, including collapsible steel fly and bait rod, oil finished fly line, bait line, two different reels, tackle box, and assorted equipment, came to exactly \$8 at one store. The steel rod is not much good for fly casting but it is ideal for brushy streams. Although cheap, the outfit will catch a lot of fish. Included in the equipment are leader gut, worms, flies, plugs, salmon eggs, and a landing net. Don't forget the last item. Most fish that get away are lost when they are being taken from the water. I lost eight fish in a row one morning because I had forgotten to take a landing net with me.

Most people troll too fast for best results and most people retrieve spinners and flies too fast. Go slow and catch more fish. If you catch a fish that is under the legal size, wet your hand in the water before touching the fish. Remove the hook gently.

Just like any other sport, practice and experience will make you a better fisherman. The man who sells you equipment can show you how to tie lines and can give you other tips because he is probably a fisherman too. Finally, watch the men who are catching fish and learn from them.

At least, that will save you from the plight of a vacationist who bought a fishing outfit, rented a boat and went fishing. He came in hours later, disgusted because he hadn't had a strike although everyone else was catching fish. Then someone noticed that he had forgotten to attach a hook to the big spinner he was using.

Rocking Gun-Mount Trains Tank Marksman

Rocking, lurching movements of a tank over rough ground are simulated by a stationary gun mount devised by a Fort Knox officer for use in training gunners to fire accurately from moving tanks. Mounted on a post through a universal joint, a wooden 37-millimeter tank gun is aimed by means of a regulation gun sight. In order to check the gunner's accuracy, a repeating BB gun is attached to the dummy. While the gunner attempts to hold the gun on a fixed target as he would from within a tank, another person wobbles the platform vigorously.



One man rocks platform while another fires at target as from moving tank

Changeable Flashlight Lenses Shine, Red, White or Blue

Safe Delay Switch Corp., 540 Lake Shore Drive, Chicago.

interchangeable colored lenses of unbreakable, translucent plastic. A lens is mounted over the bulb by its two tabs which fit into slots on the face of the flashlight. The red lens is used as a danger signal, the white

lenses for ordinary uses, and the blue lens gives a subdued glow suitable during blackouts. The flashlight may be carried by its heavy wire handle, hung on a hook, belt or coat button, or set up in easel style using the handle as a back support. With the lens removed the protruding bulb supplies a candle light as there is no reflector.



White plastic lens shown in flashlight may be interchanged with the red and blue ones in the foreground

Ice Hotter Than Boiling Water Made by Heavy Pressure

Pressure plays strange tricks with water. Dr. P. W. Bridgman, Harvard scientist, has produced ice at a temperature of 375 degrees Fahrenheit—163 degrees above the normal boiling point of water—under the tremendous pressure of 40,000 atmospheres. This hot ice has a smaller volume than ordinary ice, and sinks in water. Laboratory scientists have recently succeeded in producing pressures of 400,000 atmospheres, or 6,000,000 pounds per square inch. This is the equivalent of the pressure under a tower of bricks 1,500 miles high, or at a point 1,000 miles deep in the earth.

To learn where to buy commercial products described in these pages, see the index.

"TRACER BULLETS" of SCIENCE



instrument. The tagged atoms mingle with others of their kind and follow them around. Like "fifth columnists," they broadcast their position to this instrument, enabling the scientist to follow the path and discover how normal atoms behave and where they go. In the laboratories we have had a group of physicists engaged in exploring the uses of these newer discoveries during the past five years. This article gives a brief account of some of their results.

In making steel, the phosphorus which is present in all iron ores

Small electric furnace in which metallic alloys containing radioactive atoms are prepared

Dr. F. W. Stallman prepares to measure thickness of layer of oil on plate beneath his hand

By Dr. E. U. Condon

Associate Director
Westinghouse Research Laboratories

LIKE the "tracer" bullets that blaze a fiery path to the target and help the machine gunner improve his accuracy are the "tagged" atoms which modern scientists can follow through industrial and biological processes and learn more about metals, chemicals and the human body.

Tagged atoms are minute particles of matter that have been made unstable by bombardment in an atom smasher, such as the Westinghouse 90-ton electrostatic generator. Thus treated, the atoms are said to be artificially radioactive, sending out radiations similar to those from radium which may be picked up and recorded by a special

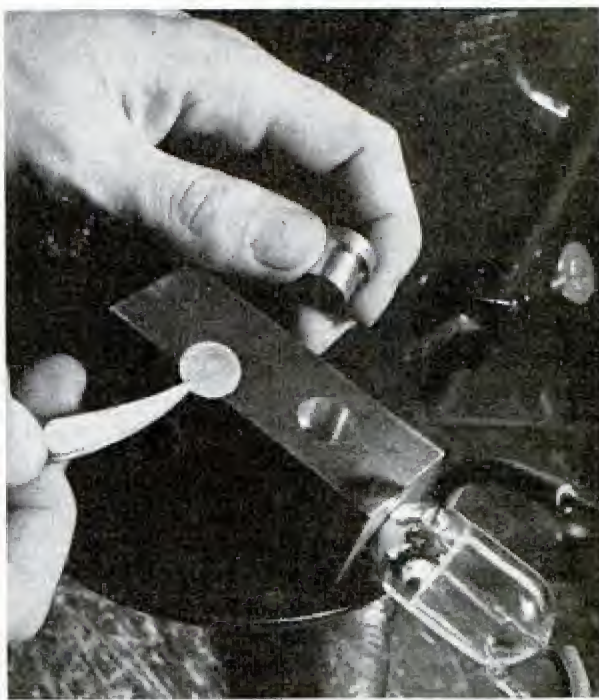


L 405

ed for the chemical analysis now used in steel mills, could speed up the measurement of phosphorus in steel 700 to 1,000 percent. It would provide a precise control and prevent occasional "over-cooking."

Device for "looking" into steel. Disk to be photographed is clamped between film and brass plates

Radioactive disk of gold (held in tweezers) to be dropped into hole in brass block for counting of atoms



Binoculars Can Be Folded To Fit Pocket or Purse



Binoculars opened for use, and folded for carrying

Having the appearance of a cigarette case when closed, small-size binoculars now on the market may be carried in the vest pocket or purse. They are said to be powerful enough for ordinary uses such as watching sports events. The hinged metal case is opened partly when the objective lenses are raised into viewing position.

Torque Indicates Engine Output Better Than Horsepower

Horsepower has been described as a fictitious measure for an automobile engine's performance. David A. Wallace, President of the Chrysler Sales Division, says that engine torque better represents the rating of engine output, and prophesies that the latter term will be more generally used when normal passenger car production is resumed. Horsepower, when used in connection with a steam engine, describes the amount of stored-up energy available at any moment by barely opening the throttle, but an automobile engine must be running to produce power, and you have to increase its speed to get more horsepower.

Automobile owners are interested in the power delivered to the driving wheels, which is torque—the twisting effort that is converted into driving motion. The ratios of the two do not vary alike with respect to the engine's speed. Here is how they rise with the revolutions of a standard 120-horsepower engine: At 400 r.p.m., 152 foot pounds of torque are developed, and the horsepower is only 14; at 800 r.p.m., the torque is 178 foot pounds, with 27 horsepower; 1,200 r.p.m. gives 188 foot pounds and 42 horsepower; turning the engine at 1,600 r.p.m., you get 189 foot pounds—only one more than at 1,200—although the horsepower is now 58. Torque reaches a maximum at approximately 1,600 r.p.m., and remains about the same for another 1,000 r.p.m. or so, after which it begins to diminish. Friction increases as speed goes up and causes lessening of the amount of torque an engine can deliver.

Wire Brush in Mechanical Drill Cleans Metal for Riveting

Metal-to-metal contact is essential where rivets are used in airplane construction in order to prevent radio interference and avoid the presence of fire hazards. Since internal and external metal parts of a plane are coated with zinc chromate paint for protection against the elements, this paint must be scraped off wherever the rivets and bolts will touch the metal. A little wire brush, mounted on a mechanical revolving tool, is now being used to clean the area around the holes. It works about 700 percent faster than former methods, releasing six men for other duties.



Spinning brush cleans metal around hole for rivet

Movable Glass Walls Stop Chill Wind on Beach



Sun bathers on beach are protected from chill winds by wood-framed glass panes, easily moved if wind shifts

Large panes of glass set in wooden frames, serving as windbreaks on the beach, enable bathers to enjoy the sunshine while protected from chilly winds

and windblown sands. Broad enough to accommodate several people, two transparent walls are joined at right angle, and may be moved should the wind shift.

Blackout Bulb Sheds Downward Beam of Soft Blue Light

Silvered inside to provide a downward beam that cannot be seen from outdoors, a new blackout bulb offers soft illumination for the home during air raids. The 25-watt bulb is covered with a black silicate coating to prevent light leaks, and its tip is dark blue, shedding a blue light.



Black-coated bulb sends a soft blue beam downward

Truck Gardener Fools Rhubarb Into Growing Extra Crop

Market gardeners around St. Paul, Minn., have kept up production through the winter by "fooling" rhubarb into growing an extra crop. During October they dug up the roots and soil in which they were embedded and transferred them to sheds to be frozen. This gave them the accustomed rest of winter, and when steam heat was turned on about Dec. 1 and at intervals from then on in the several sheds, the rhubarb awakened into growth. One winter rhubarb grower produced 40 tons, and the total of several market gardeners was about 100 tons, \$125,000 worth.



21033

The **RACE** *of the*

"IRONING BOARDS"

Plan #701

ROUGHEST and toughest race in the world—that's what they call the event which has been staged each year between the isthmus of Santa Catalina Island and Hermosa Beach, Calif. The contestants ride across 44 miles of open ocean on aquaplanes, or "Ironing Boards."

Last year's race was the first in which

Rider at left is slightly ahead, so rival gets full force of wake, plus that from boat not in picture, making the going very rough

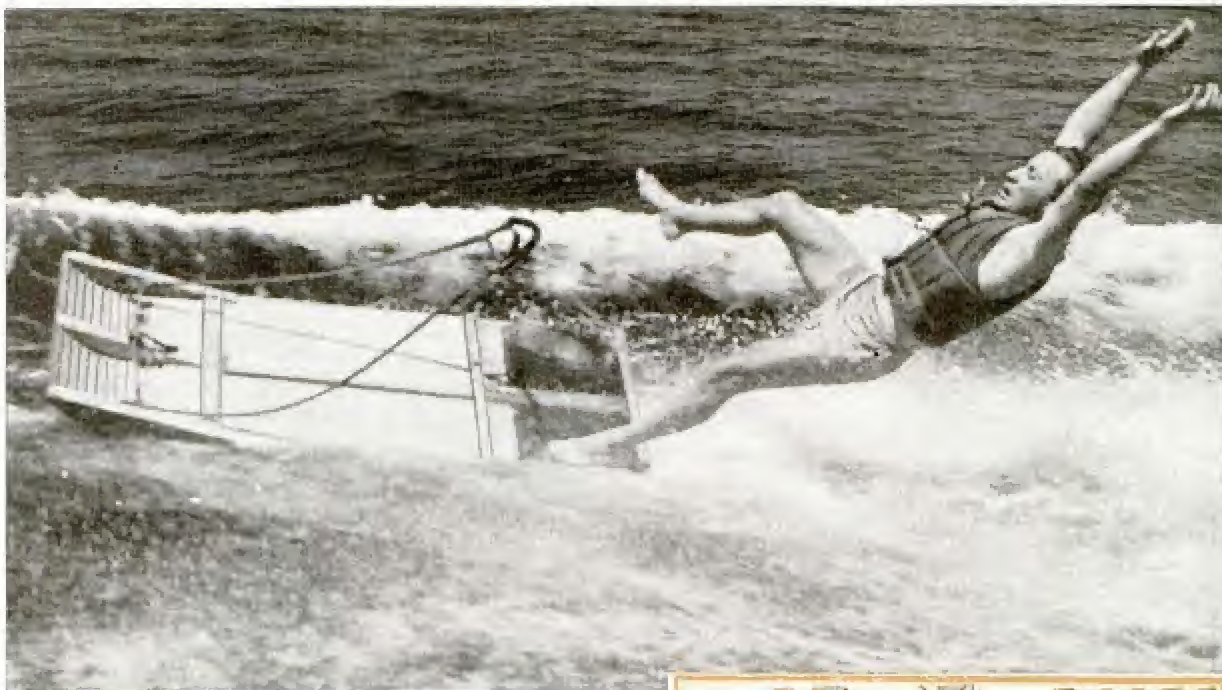
more than a third of the starting contestants were able to endure the grind to its finish—and then the sea was like glass, the waves never over six feet high. Only in that event were there no injuries, in contrast to the half dozen cases of broken

arms, legs, ribs, and collar bones that are the normal toll.

One of last year's participants, who got a pretty heavy handicap because of his speedy boat, was making a gallant bid for second place in the race. He had ridden the 44-mile stretch at top speed, was too late to finish first, but looked good for sec-

Mid-ocean battle, with each rider trying to create waves that will throw some contestant off the board





Into the churning wake goes this rider as water gets so rough he can hang on to his board no longer

ond. As he neared the finish, spectators saw that he was not holding his rope, but had passed it around his back, and his hands were hanging limply—he was too far gone to hold on any longer.

A cheer that went up for his courage died in a gasp. Forty feet from the finish line, he collapsed. He did not fall off, he did not get knocked off—he simply didn't have 40 feet left in him. When a man cannot hold on for 40 feet more at 50 miles per hour, he is through, and only sheer exhaustion can account for it.

The first race was held in 1935, and was really more of a stunt than a contest. Since then the fame of the event has spread, with aquaplane riders coming from all over the world to participate. It is the only aquaplane race sanctioned by the American Power Boat Association, and so far as is known, the only aquaplane race that uses open, uncharted ocean for its course.

Speeding across 44 miles of open sea creates problems that few other races have to contend with. There are no landmarks and the boat operators depend almost exclusively on navigation instruments to tell them where to go. Since a one-mile diversion from the true course is enough to lose the race, it is easy to see that teamwork between the rider and the operator of the boat is vital.

Some of the participants spend weeks



This map shows the course; uncharted, it calls for boat operators to use navigation instruments

going over charts of the ocean winds and currents, trying to outguess air and water movements to their advantage. Some have been rather successful. The general practice is to start from the island and head straight for shore, but it may pay to lose a mile or two if one can find a current traveling two, three, or four miles per hour.



Down into the brine goes another contestant as wakes from two other boards make it impossible to hang on another instant; spilling rival in this manner is not prohibited



A three-way contest, with center rider (the same one who fell in photo at top of page) getting the worst of it

Weighing in ceremonies for the boards. This one, four pounds too heavy, had to be dried in hot sun before being approved



This race is on a handicap basis; handicappers endeavor so to calculate the speed of boats that if all things were equal, they would finish in a dead heat at Hermosa Beach. Consequently, those with the fastest boats start last, and have to fight their way not only through the normal waves, but through the wakes of boats ahead of them. The rules do not prohibit catching an opponent in the wake of your boat, and making the going difficult, even disastrous. A spill costs a contestant at least four minutes, and spills are many.

To avoid these spills, contestants have made many experiments with their boards and the best methods of lashing them to the boats. Boards are limited to sev-

enty pounds by rules, but there are many variations in design possible. The original boards were simply flat, but these were unstable and took a terrific pounding from the waves. Since then, everything has been tried—fins, keels, round-bottom boards, and a score of fancy geegaws and gadgets. Experience has indicated that fins or keels are an advantage on the round-bottom boards; they add to stability and detract little from speed.

Even more broad have been the experiments with the towing ropes. The bight of the line drags the water, and not only offers some resistance, but when several waves come close together, it is

difficult to get the board over them, and going straight through is a rough process that may spill the rider any moment, and certainly wears down his stamina. In rough water the line has a tendency to whip and jerk, and this poses another problem.

One rider and his boat crew designed a spring reel for the stern of the boat that was supposed to prevent jerking. Every time the line went slack, it was automatically gathered in. This worked fine in rough water, but when a smooth stretch was encountered, the board was drawn in so close spectators thought it was going to pass the boat. Another rider and crew formed a U in the line, and across the crest, they placed heavy strips of inner tubing that were supposed to take up the shock. It was only mildly successful.

Others have designed all sorts of high masts and spars on their boats to tie the line high, figuring to keep it out of the water. Still others have attempted to tie the end up forward, figuring the boat would be more maneuverable under better control. Some of them still swear by such trick stuff, but general experience has been that the line should be tied low in the stern, for the best general performance.

In 1940, Jack Burrud, who won the first race and has ridden in every one since, suffered a fracture of his elbow in an accident. By 1941, he had only partial use of the arm, but he fixed up a special brace,



It's all over for this contestant, shown being pulled aboard boat in mid-channel. A spill means loss of at least four minutes, usually more

and rode the gruelling 44 miles to the finish.

There is the story of a girl whose courage will long be remembered. A rough sea spilled her and she came up with a compound fracture of the left wrist, but she got back on her board and tried to finish anyway. The Coast Guard, which keeps a constant patrol both in the air and on the sea while the race is in progress, saw her left arm hanging limp and pulled her out of the race.

Then there is the story of the two boys who disappeared during a race. Their boat failed to come in at all. Alarm for them soon spread. At last a frantically searching Coast Guard found an oil slick in mid-channel. Their radio flashed word of the ominous discovery and presently the sea was alive with searchers. But no sign of the boys was found. By dusk Uncle Sam

(Continued to page 168)

Here is one of the four girls in the 1941 race, the first in which any girl contestant ever finished



Glass Opaque to Slanting Rays Guards Against Air Raids



Upper half of glass is opaque because it is viewed at angle

Peculiar properties of specially treated flat glass make it transparent to light rays and vision at an angle of 90 degrees, but looked at from above at a 45-degree angle, it becomes opaque. Used as window glass, it is in keeping with the present air-raid precautions campaign. To an observer on the ground, or on the same level as the window, the glass is clear. However, to the warbirds overhead, a factory's windows would give no visible light to mark it as a target.

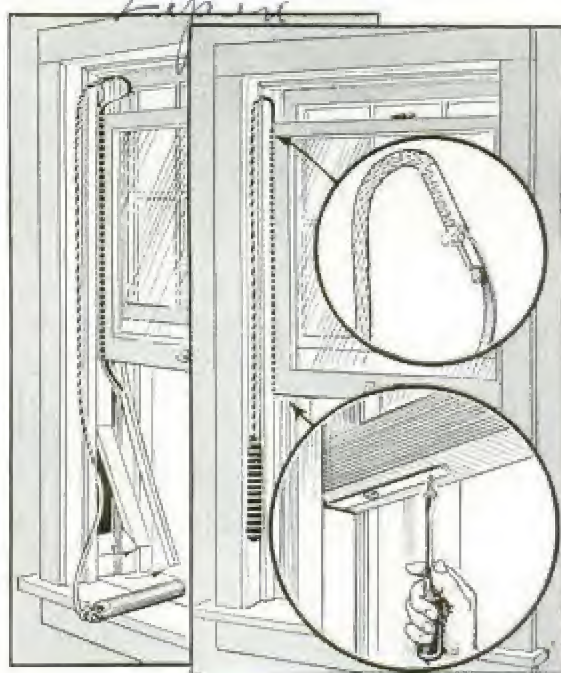
Automobile Era Ended by War Saw 69,000,000 Cars Built

In the 42 years which constituted the first automobile era, the American factories—now diverted to war production—turned out more than 69,000,000 motor vehicles. In the years since the first world war 61,900,000 passenger cars were built. Wholesale value of the passenger cars built since statistics were first recorded in 1900 amounts to \$44,000,000,000, of which \$38,000,000,000 was made in the last 22 years. Production of trucks reached an all-time record of 1,270,647 in the United States and Canada in 1941, military trucks accounting for about one-fourth of this number, but passenger cars built last year totaled only 3,838,345, leaving the year 1929 still on top

with 4,794,898 and 1937 second with 4,068,935 cars. All passenger car production for private use ceased by government order in February with about 600,000 of these cars still await rationing.

Sash Cord Easy to Install With Window in Place

Replacing a broken sash cord, ordinarily requiring removal of the window sash from the frame, can be accomplished in easier manner by using a cord having a flat brass strip attached at one end. The job is simple. Removing the loose pocket cover exposes the sash weight which then is lifted out. Then the brass strip is fed downward between the window sash and the frame, bent along the bottom of the base rail and secured with screws. The cord is then inserted over the pulley and fed down into the pocket, where, with the window as high as it will go, the cord is tied to the weight, leaving the cord short enough to allow for some stretch. Swinging the weight back into the pocket and replacing the cover completes the installation.



Sketches show how metal strip slides with window sash, and rope, attached to weight, rides over pulley

7m 10 3.

Jap "Sub" Had Guard for Cutting Net in Harbor



Examination of a two-man Japanese submarine that was captured during the attack on Pearl Harbor shows that it had no chance to carry out its destructive mission. The craft's two torpedoes remain in their 18-inch tubes. At the prow is mounted a knifelike guard with which it was intended to cut through the submarine net protecting the American base. The vessel, 41 feet long, with a plating one-quarter-inch thick and a conning tower four and one-half feet high, has a speed of 24 knots. It could be carried aboard a larger vessel and probably launched over the side. The baby sub has a cruising range of 200 miles.



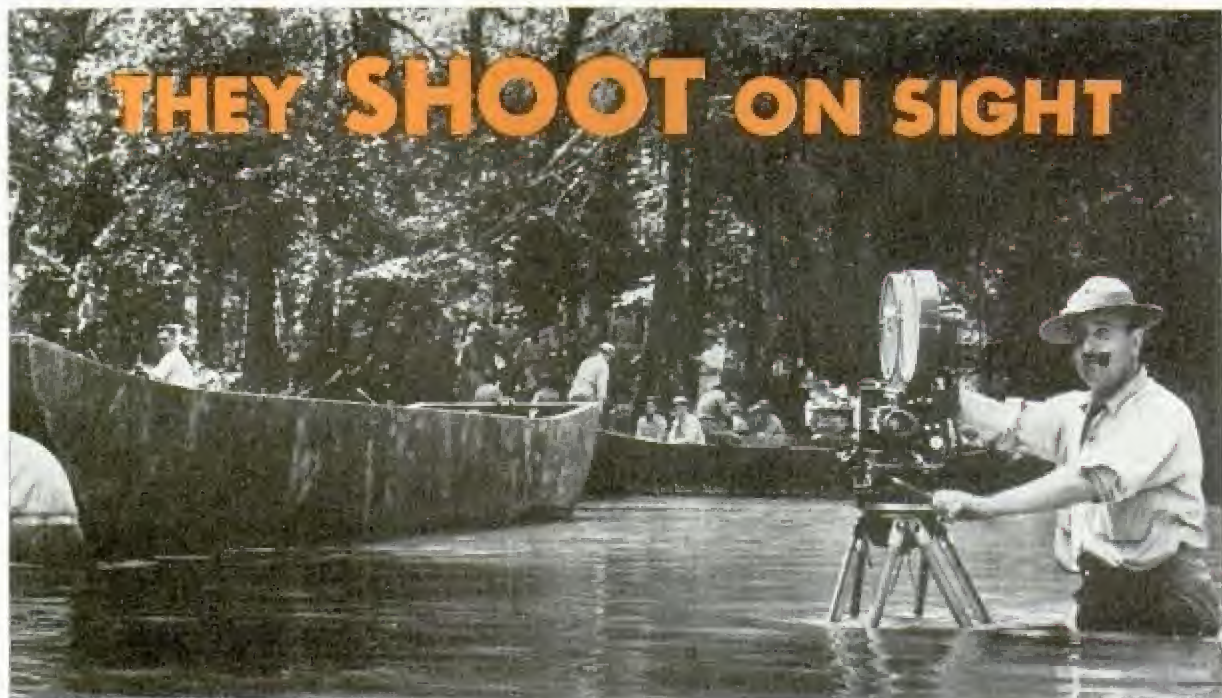
Men walking alongside submarine, top, give some idea of its small proportions. Bottom, knife-sharp cutter at bow intended to cut harbor net

Lightning Enriches the Earth by Producing Nitric Acid From the Air

Lightning has some good points as well as bad. In streaking through the atmosphere at 60,000,000 miles per hour, thunder bolts release nitrogen from the air, which later falls in the form of nitric acid with rain drops to enrich the soil. In this way, Westinghouse engineers explain, nearly 100,000,000 tons of nitric acid are produced

annually. Also, lightning restores the electricity that seeps constantly from the earth to clouds, thus recharging the earth like an electric battery. Two billion lightning strokes, which occur during the 16,000,000 electric storms each year, take part in these processes. An average stroke represents about one billion kilowatts.

THEY SHOOT ON SIGHT



Army barges perform in a landing operation while the cameraman, up to his hips, grinds away in midstream

By Roderick M. Grant

THOUSANDS of feet above the "enemy" lines a U. S. Army "blitz" photographer trips a shutter, thrusts the film into a little black bag and in less than five minutes a finished print showing a concentration of hostile forces is plunging to field headquarters in a metal tube.

Three-dimensional films detect the ground swell of a patch of pillboxes that is flat and barren in the "one-eye" photograph, and the color camera discerns cam-

ouflage that blends in unnoticed patchwork on the black and white print.

The army sees with thousands of glass eyes. Yesterday's amateur snapshooters have been training as Signal Corps photographers at Fort Monmouth, N. J., or air force cameramen at Lowry Field near Denver. Movie men waist-deep in water grind away as army engineers bridge a stream. They go to Hollywood to learn technique for producing training films, and



The army movie camera "covers" war maneuvers, producing a film for officers' study and to train recruits

graduates of the Disney Studios are loaned to the army to "animate" slide films that teach aerial navigation or gunnery or military traffic control. Just recently the army acquired a large motion picture plant in New York City and is transferring the Fort Monmouth film laboratory to this new photographic base.

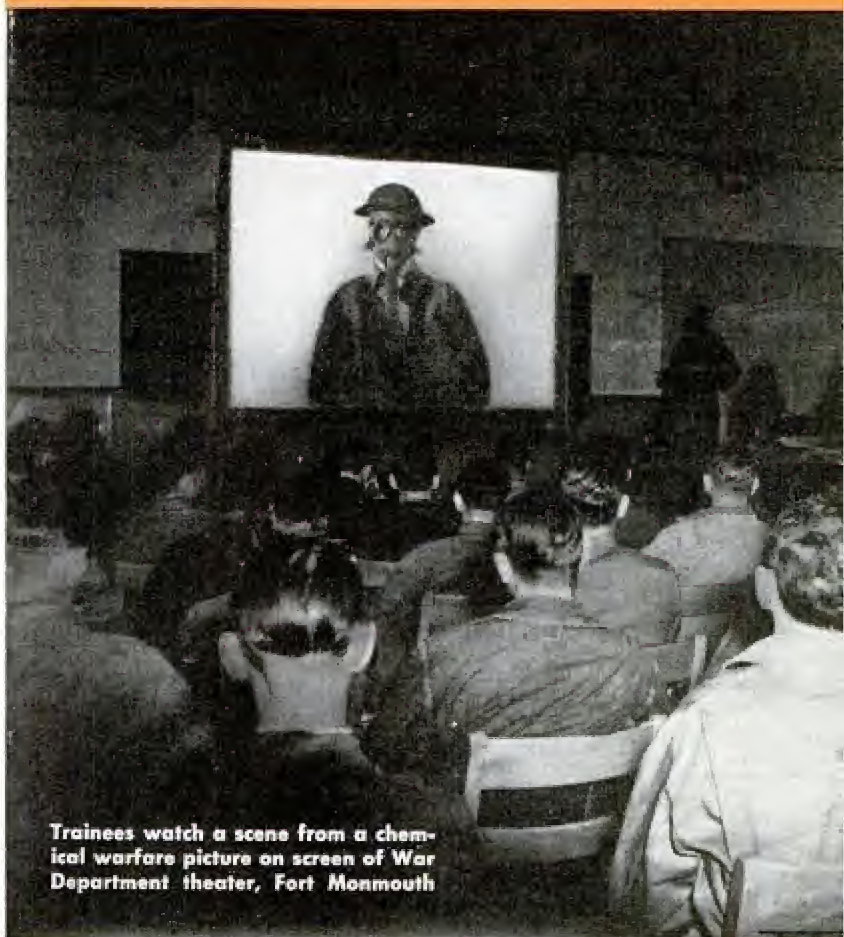
Your Uncle Sam's army has always been right up among 'em in the business of war photography. The Signal Corps is custodian of a priceless pictorial record of the Civil War and the World War. The Army was the first institution in this country—probably anywhere—to use motion pictures for mass instruction. In the last year of the World War 60 movies were produced for army training purposes. Today there are many more training films in production, the Signal Corps is pioneering in the use of sound films, and the techniques of army cameramen in '18 are as outmoded as the soundless "flickers" of that day's dime shows.

Troops being schooled for war sit in a lecture hall and watch a battle develop on a screen. A bomb explodes, and the sound of the blast bursts through the room with frightful realism, the purpose being to accustom soldiers to the din of battle. Tank crews see a projectile strike a medium tank and hear the detonation of the hit as recorded from inside the tank. Two tanks crash together in synchronous sight and sound. The peculiar whine of machine-gun bursts ricocheting from gravel accompanies a vivid attack scene.

"Blitz photography" is



"Newsreel" cameramen of the U. S. Signal Corps clamber atop a truck to "shoot" a film for Fort Monmouth Training Film Production Laboratory



Trainees watch a scene from a chemical warfare picture on screen of War Department theater, Fort Monmouth



From rear cockpit of an observation plane, engineer of the Air Force "quick photography" project at Wright Field trains one of the "big guns"

one of the specialties at Wright Field, Dayton. Long-range artillery may be firing at an enemy concentration beyond eye range, or "panzer" units may be preparing a surprise attack on the U. S. Army's flank. The commanding general needs immediate accurate information.

An observation plane gets the order by radio to obtain quick photographs. Already "upstairs," the observer trains his Big Bertha camera on the terrain. He needn't focus the 20-inch telephone lens; the plane is high up, and the focus is fixed at infinity. He has only to figure the exposure time and lens opening.

The shutter snaps, and instantly the film holder is pulled from the camera and immersed in the first compartment of a compact four-bin processing tank. He doesn't have to see what he is doing. He pulls the slide up out of the holder and uses it to agitate the holder in the tank, where the negative is developed for one minute. Then he replaces the slide and moves the holder to compartment two for a 15-second "stop bath." In the third tank the negative gets 75 seconds in a fixing solution, then a five-second water rinse in the fourth section. Each section of this tank has a nonspill lid so that its chemicals are immune to the bouncing and banking of the plane, and its insulating jacket, 1½ inch thick,

is electrically heated to a constant temperature of 75 degrees. Development has taken 2 minutes and 35 seconds.

Sponged off with a rubber squeegee, the negative in another half minute is ready for the next stop—an efficient little printer packed in a light-proof zipper bag. Here again the aerial photographer works by the touch system, seeing nothing. Thrusting his hands inside the black bag, he lays the negative on the printer and covers it with a sheet of trans-

parent material to keep the printing paper dry. Sensitized paper is then placed over the film and the lid is brought down, making the exposure with light from a single bulb. After five or ten seconds in the printer, the paper gets the quick 1-2-3-4 routine of 20 seconds in the developer, 20 in the stop bath, 15 seconds of fixing and a five-second rinse. Drying is skipped; the wax-treated paper sheds moisture, and the print is immediately thrust into a light metal cylinder with sponge-rubber shock absorbers and dropped to the ground. A waiting motorcyclist or jeep car courier rushes it to the field commander. Working time from shutter click to metal tube is

Complete time and space record of plane landings and takeoffs is filmed, 3 exposures per second, from hut on Wright Field





Photo from U. S. Signal Corps

Shooting a scene for film to instruct soldiers in chemical warfare attack and defense at Fort Monmouth, N. J.

only four minutes and fifteen seconds.

Never satisfied, the Wright Field researchers under Lt. Col. George W. Goddard are working on techniques that may slice time even thinner. One employs the portrait-while-you-wait method of the amusement-park photographer. Here the negative is omitted, the picture being taken directly on paper. Thus far this process has proved inefficient because of the limited sensitivity of emulsions; only in most favorable daylight can a sharp print on paper be captured by the direct-positive system. But the army is trying for paper with a wider exposure range.

Another blitz photography technique utilizes a portable field darkroom developed by Lt. Col. Goddard. Attached to division headquarters, it weighs 50 pounds fully equipped, and can be set

The Signal Corps' training film production crew goes into field to film the technique of soldiers advancing through a gas attack

up in less than five minutes. The darkroom is a camouflaged tent five feet square, supported by four pneumatic arches inflatable by hand pump, air flask or from the spare tire of the jeep. It has a lightproof black fabric lining, rubberized floor that is both waterproof and acid-resistant, and zipper door flaps. A rubber tank holds water for processing, and a small air-con-





Lt. Col. George W. Goddard at Wright Field holds the largest roll of film in the world, used for army aerial photography

ditioning unit provides hot or cold air at the right temperature, whether it's Alaska or the Panama Canal zone. In the world war, photographs were flown to laboratories 30 miles back of the lines and it took hours to deliver prints to field headquarters. Today's blitz photographers can deliver a photograph of an enemy mobile battery before it can move its position.

There are more tricks in the repertoire of the Wright Field technicians. They consigned to limbo the test pilot's knee pad on which he scribbled performance notes while jockeying an experimental ship

Four inflated pneumatic arches support this portable darkroom tent for developing film in the field. Black rubberized fabric makes it lightproof



through rolls and dives; to replace the knee pad they built a "Photographic Observer," a 35-millimeter motion picture camera, a lamp house to provide lighting, and a mount carrying instruments duplicating those on the cockpit panel. At the touch of a trigger switch on the pilot's stick he can record on film the readings from as many as 15 instruments.

To record accurately the take-off, flight and landing performances of planes under test at Wright Field, a gun camera using 35-millimeter strip film snaps three pictures per second as it follows the plane from a portable camera shack opposite the midline of the field. A stop watch is included in the camera's view so that the pictures constitute a precise time-distance record of the plane's trial.

One of the newest tools of the military cameraman is a three-dimensional film invented by Douglas Winnek of Mt. Vernon, N. Y. Unlike the stereoscopic pictures which require two images taken by twin lenses at eye distance apart, the new Trivision film needs but one exposure. Ordinary black and white film, color or X-ray film can be used. Winnek softens the back of the film, then impresses on the back (not the emulsion side) an optical screen consisting of minute grooves, about 200 to the inch. The "lenticulated" film is loaded into the camera, its grooved back toward the subject. The image "filtered" through this optical screen

has depth when viewed as a transparency through the back. From the emulsion side the three-dimension effect is lost.

The Trivision film has been used at a Navy hospital to make three-dimension X-ray photographs of patients. With it the surgeon can gauge precisely the position of a foreign object in the body. With it the air corps photographer might show the depth of a valley, the height of a

(Continued to page 174)

Disabled Tank Rides Trailer to Repair Shop



Two oblique tracks at back of trailer form ramp on which disabled tank is loaded and unloaded

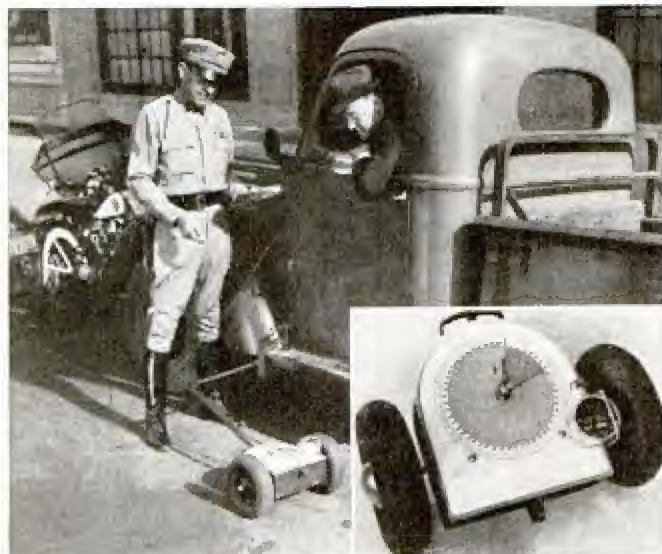
British tanks put out of commission while fighting in the Libyan battlefields are "ferried" across desert wastes to central repair shops on special heavy trailers. Although the tanks are hardy cruisers, they frequently become immobilized since there

are many things that can go wrong. The huge trailer is equipped with two stout steel runways hinged at the back, which can be lowered for hauling the tank aboard. Both the truck and trailer have heavy tires designed for desert travel.

Brake Tester on Wheeled Cart Shows Stopping Distance

Efficiency of automobile brakes can be determined under driving conditions with

a two-wheeled tester that is attached temporarily to the car. Built into the cart and geared to its axle are a speedometer and a distance meter. These two instruments, on completion of each test, show how fast the car was traveling when brakes were applied, and how far it traveled before stopping. A solenoid, connected to a control pad which in turn is attached to the brake pedal of the automobile, controls the mechanism. As the driver steps on the brake he closes an electric circuit, actuating the solenoid, which immediately "freezes" the speedometer and releases the distance meter hand. For testing power brakes or trailer brakes separate from the tractor brakes, a control pad can be slipped over the hand lever.



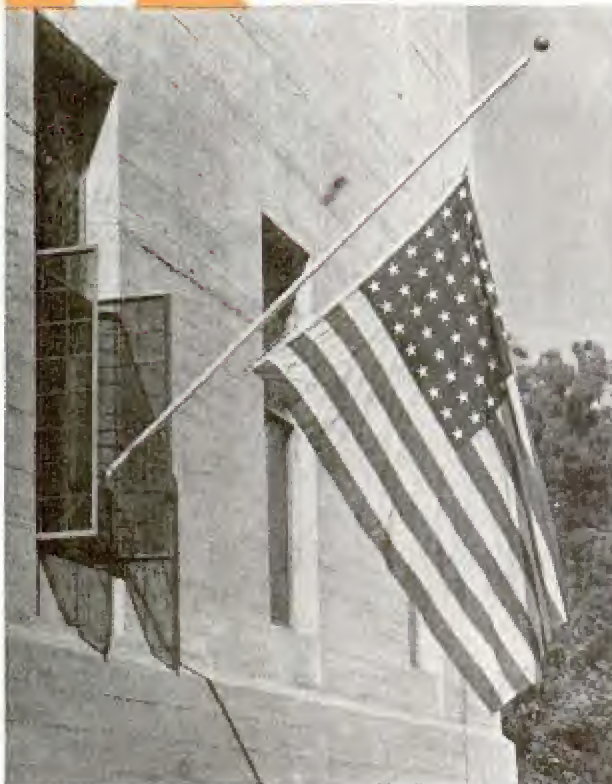
Tester shows how fast auto stops after brakes have been applied.

Capt. Marshall Perham, 1128 Higgins Ave. 1141

SHOW



Every patriotic American is eager to display the Flag in this time of national emergency, but not all are sure about the proper ways to display the colors under varying conditions. Above, correct techniques are shown: the Flag on right with state and organizational flags following in order, civilians salute with hand on left breast, sailors give rifle salute and soldiers the hand salute



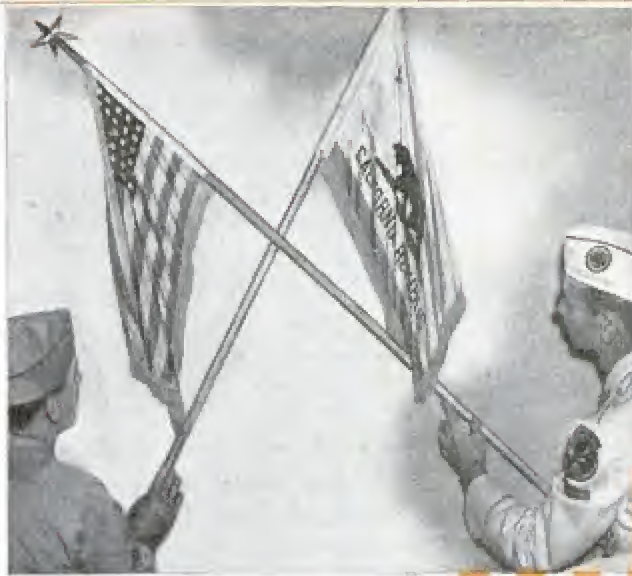
Sticker type flags should be displayed on right side of windshield. Theoretically they should be at top, but to comply with most state laws, may appear in lower corner above other stickers



Flag floating correctly at half staff out the window. For projections from buildings, the staff should be either fully horizontal, or at a 45-degree angle

21141

YOUR COLORS



Above, when two flags are crossed against a wall, Old Glory should be on its own right, with its standard above the standard of other flag. Below, star field always should be on the Flag's own right upper corner in a vertical display. The only exception is for a distress signal when the star field is hung downward



Proper place for the Flag on auto is radio antenna pole (above). Place it high to avoid touching anything. It must be detached after dark or in bad weather. Below, in hoisting the Flag, it is attached to halyard and allowed to unfold as it rises. Hoisting should be brisk, lowering slow



Sky Map Lighted for Study By Flashlight Attachment



Turning on the flashlight illuminates the map clearly

Illuminated maps of the heavens are offered in a handy frame to be used with a standard flashlight by anyone studying the skies. Under the four-by-eight-inch glass cover, various maps and charts on tissue can be installed, the names and locations of the constellations appearing white against the opaque black background when the flashlight is turned on. On one sheet appears the international Morse code, which can be learned by dot-dash signaling with the flashlight beam.

Small Bracket to Hold Ant Poison May Be Nailed to Tree

Ant poison can be set within easy reach of the insects by putting it in a tree bracket that helps to prevent children and pet animals from reaching the poison. Manufactured by the



Protective bracket holds bottle cap with ant poison

tured of thin metal in a single piece, the bracket is bent over to hold a crown bottle cap, the latter serving as container for the poison. Two sharp points turned outward are driven into the tree or post in mounting the bracket, and the bottle cap may be filled with poison by means of an oil can after the bracket is in place. One filling usually remains effective two weeks, after which the caps may be removed and replaced with freshly filled ones, and the used caps washed in boiling water. The upper portion of the bracket forms a roof over the cap, retarding evaporation and keeping out dust and rain.

Transparent Plastic Tableware Replaces Metal Servers

Scarcity of metals due to defense production may be credited with bringing more beauty into the kitchen. Made of crystal-clear Lucite and Plexiglas, a new line of tableware includes cake server, scissors-type salad set and pickle tong,



These are a few of the transparent plastic servers

marmalade ladle, pie wheel, cheese knife, salad fork, napkin rings and other "tools." The edges are finished in green, blue, gold or red; attractive color effects are produced by sidelight filtering through. They are rustproof, stainless, easy to clean and lightweight, but care must be taken not to wash them in hot water or to rub them with abrasives or rough cloths.

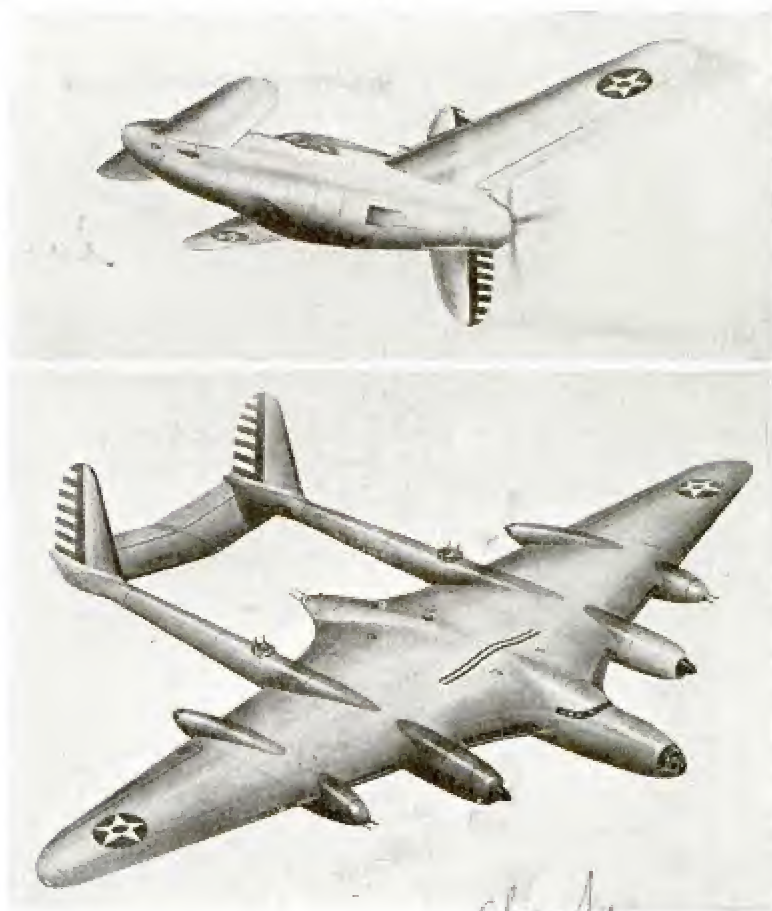
WANT MORE INFORMATION?

When you want more information about a product described in this magazine, note the page on which it appears and turn to the Where-to-Buy-It index. There you will find listed the name and address of the manufacturer or distributor if the article is commercially available. Write to them and Say You Saw It in Popular Mechanics

U.S. Air Forces "Pusher" Warplanes Offer Higher Fire Power

Engines in tomorrow's fighter planes and bombers will be arranged to give the craft the best possible defensive fire power, according to military aviation experts. Although details are closely guarded secrets, the outward appearances of some have been made known. One, called the "Canard," would fly tail first with the propeller at the extreme rear, thus eliminating rough air over the plane. One four-engined bomber would have two propellers of the pusher type and two of the tractor type mounted in the wings. Both designs offer advantages in the placement of guns.

Plane, top, has tail foremost, wings and propeller at rear; bottom, two propellers pull and two push this ship



M 94 Portable Hand-Operated Siren Used by Air-Raid Warden



Spartan model 100
Useful in districts where electric power is not available, a lightweight siren operated by hand has been introduced here from England for use during air raids. The siren may be mounted permanently on its broad base or slung from the shoulder by straps. Easy for either a man or woman to carry and operate, the siren produces a powerful, far-reaching tone within two seconds. Thousands of the small sirens already are being used in England and other allied countries by fire and air-raid wardens, industrial guards, police and soldiers.

Portable siren may be mounted as at left, or carried by air-raid warden.

Baby albatross -

83 volus sailplane
cno 13785 Pastor

2123



Here is a sailplane in flight—graceful, but highly useful for military purposes. Here it is shown being towed into the air

TRAINING the GLIDER ARMY

San Sebastian
Calif

GLIDERS are apt to play an increasingly important part in the military establishment of the United States, as a means of quickly transporting large bodies of troops and perhaps small tanks.

The Germans demonstrated at Crete the troop-carrying ability of gliders. "Trains" of sailplanes, towed behind airplanes, cast off from the towing planes at a great height and coasted many miles ahead to their objectives. Each glider, according to reports, held about eight fully armed soldiers, including the pilot, and each had separate mobility from the moment it cut loose from the train to make a landing.

Sailplanes are used most advantageously where the fighting is

← John Robinson, a record-holder, in sailplane at Sun Valley, Idaho

This is one step in assembling sailplane from parts carried on trailer
↓



Cond. Valley Id. Nov 1940
6902 Magnolia Ave Chicago

21234



Sailplane just leaving the ground while being towed. Larger craft some day may carry U. S. troops and tanks

over an area so large that troops may be landed from them out of range of enemy fire. Even though an occasional glider crashes on landing, its low cost—a slight fraction of that of a power plane—makes this type of aircraft a relatively inexpensive item in modern warfare.

Last summer two groups of U. S. Army officers, all of them pilots of power planes in the Army Air Forces, took three-week courses in glider and sailplane flying. One group went to the Elmira Area Soaring Corporation's school at Elmira, N. Y., the other to ~~Frankfort-Lewis~~ School of Soaring at Lockport, Ill. This was our initial step so far as military efforts are concerned, in the glider field.

If it were desired to move a force of 100,000 men across the country, it could be done in 36 hours by utilizing about 1,000 transport planes, each towing three gliders of 15-man capacity, at a speed of 100 to 200 miles an hour. They could take full equipment, plus machine guns, light cannon and even light tanks, according to one authority. But the

M. I. J.

Power winch used to launch sailplanes. High in the sky is a sailplane whose pilot has not yet cast off the tow line



MAY, 1942

*Thermal gripper
Schweitzer 2/24*

2/12/34

Bowbus Sailplanes, Inc.
137 85th Street
San Fernando
Calif



And this is the Bowbus "Baby Albatross" rising from the ground with the tow line plainly visible. German inventors are reported working on designs for sailplanes which will carry ten-ton tanks

vision of the army is not stopping at 15-man sailplanes, for their size is limited only by the power of the planes towing them, hence fifty-passenger craft are within the realm of probability.

Construction of a modern sailplane factory, the entire output of which will be taken by the Army, was started recently at Lockport, Ill., by the Frankfort Sailplane company. The company has been making gliders for civilian use for several years.

The course taken by the army officers at the Frankfort-Lewis school was typical of

both groups. Each pilot received 30 hours' training during the three weeks. Two-place training gliders were used for initial

Germany is developing a glider capable of carrying a five-ton war tank, which would be towed by a large bombing plane, and is designing larger sailplanes to transport ten-ton tanks, according to reports reaching England.

instruction, each man making eight flights with an instructor before soloing. The training gliders are certificated by the

Civil Aeronautics Authority to withstand a speed of 88 miles an hour when towed by a plane.

During the course each army pilot averaged 225 glider landings, and demonstrated his ability to bring his motorless ship down on a designated plot of ground about 25 feet square. Individual flights, sustained solely by air currents, ran from an hour to two hours and twenty minutes.

So far as glider records go, the endurance record is German-held, at over 36 hours in the air without a landing, with return to point of departure. Likewise in German possession is the altitude

This is another view of the power winch with operator at his post



record of 22,434 feet. The Russians, who have long been experimenting in the glider field, hold two records for distance—465 airline miles, and 212 miles with return to point of departure.

American-held records are: Altitude, 17,263 feet, by Robert M. Stanley; airline distance, 290 miles, by John Robinson; duration, 21 hours, 34 minutes, by Lt. William A. Cocke, Jr.

Gliding has its thrills and dangers. Maj. Fred R. Dent, Jr., one of the pilots attending the Elmira course, ran into some of them when he took to the air in company with John Robinson, holder of the American distance record, in a two-place glider. After being towed aloft to 4,000 feet, Dent and Robinson cut loose from their tow. They entered a cloud at 3,700 feet, and started sailing on instruments. The variometer showed that they were climbing and they started to spiral. They passed out of the cloud at 8,000 feet, and again started climbing, while the windshield and wing edges began accumulating ice.

About this time, with the altimeter reading 9,500 feet, the airspeed indicator ceased functioning. Robinson's variometer, in the back seat, was still functioning, and he kept Dent, who was piloting, informed of their rate of climb. At 10,000 feet the altimeter had reached its limit of readings, but the air currents kept pushing them up.

Instrument on nose of two-place sailplane detects rising currents of warm air



Night photo of pilot ready to take glider into the air

Then the bank-and-turn indicator quit—frozen. Ice was everywhere, deposited by precipitation from the cloud at that altitude. Of the instruments on Dent's board, only the compass continued to work.

They reached what they believe was about 15,000 feet. By the time they broke out of the cloud they were then in, even the floor inside the sailplane was covered with what looked like snow. With no upward currents now, they began to descend, and as they reached lower and warmer levels the instruments again began to function. They landed successfully in a field—but 100 miles from their destination.

Sailplanes are launched by three methods: power-motored winch, which pulls the glider toward it and up in the air by means of a long wire cable winding up on a drum; towing via a moving automobile; and towing by airplane. The winch method utilizes about 2,500 feet of cable, and the glider is able to attain around 800 feet of altitude before casting off.

In taking off behind a power plane, the process is simply one of handling the glider so that it does not add to the difficulties of the airplane pilot. The latter starts his run on the ground for the take-off, while the

(Continued to page 162)

"Grass Blitzer" Keeps Army Airfield Trimmed



Tractor, top, tows the nine cutting units; bottom, cutters loaded on trailer for trip over highway

Because concrete and other hard-surfaced runways make wartime airfields easily spotted from the air, the army is now using grass fields extensively. Keeping such fields in condition involves a lot of grass cutting, and this problem has been solved by a tractor-pulled gang mower, called a "grass blitzer," that can trim a 500-acre field in a little more than 10 hours at 20 miles an hour. For transport, the com-

plete mower can be loaded on a trailer which is towed by the same tractor that pulls the mower. In use, the cutting portion is suspended from the frame so it will clip evenly and prevent the appearance of telltale takeoff marks. Equipped with floodlights for night operation, the mower also carries a short-wave receiver so the field officer may signal the operator when airplanes take off or come in.

Phosphorus Made Radioactive Aids Cancer Treatment

Use of radioactive phosphorus in treating certain types of cancer has given encouraging results, according to a report by Dr. John M. Kerney of Memorial Hospital in New York City. Phosphorus is made radioactive in a cyclotron by shooting an extra neutron into the nucleus, or core, of its atom, increasing its atomic weight from 31 to 32. This radioactivity has a "half-

lifetime" of only 14.2 days, but the advantage of activated phosphorus over radium is that the former can be administered by mouth as well as by injection. Since phosphorus is taken up more readily by the more active tissues of the body, the element becomes concentrated in the malignant cells where its radiations perform the same work achieved by radium and

286.
X-rays. Of 22 patients with lymphosarcoma and 27 with chronic leukemia, both fatal forms of cancer, about 50 percent were still living after periods of treatment varying from six to 15 months, and several were apparently free from the disease. Although no patient is regarded as cured until he has remained free from symptoms for at least five years, these results, together with research along other lines, inspire hope that medical victory over the disease may not be many years away.

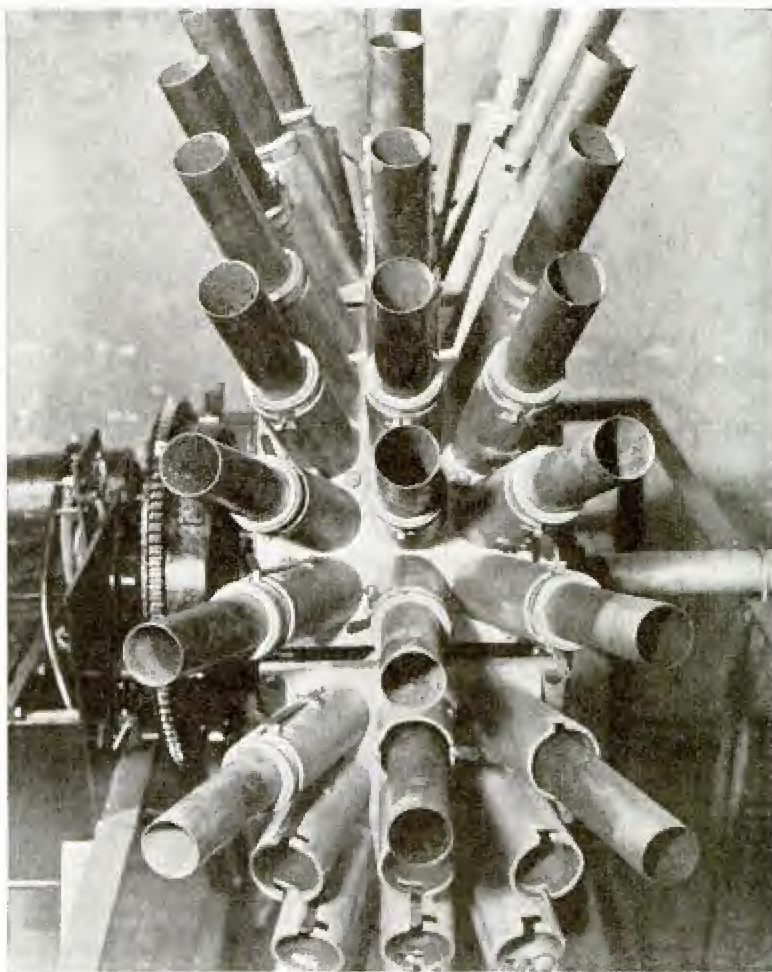
Freight Car 'Hood' Guards the Cargo From Rain

Freight cars can be loaded or unloaded during inclement weather without letting the cargo get wet by erecting a folding canopy about the car door. Consisting of waterproof canvas supported by tubular steel framework, the canopy weighs 40 pounds. When attached to the freight car door it is 7 feet high, 5 feet wide and 5 feet long.



When folded as at left, canopy takes little storage space. Over freight car door, it keeps rain and snow from striking cargo being loaded, right

Multi-Barrel Gun Sprays Shells To Strafe Sky or Earth



This electrically operated airplane gun fires fifteen barrels at a time

Efficient ground-strafting power is claimed for a new multi-barrel gun designed for installation in an airplane.

Experts say a novice gunner can learn its operation in a short time. The gun is operated electrically, will not jam and fires 15 shots with a single push of a button. Solid shot, shrapnel, gas shells or flares may be fired, and it is said that a single plane armed with this gun could virtually wipe out an entire squadron below.

Look in the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

General World Commerce
2021 Pennsylvania Ave.
Washington D.C.

2 1342 Curb. Lane. Hollywood.
4485 Beverly Blvd.

MINING A CITY DUMP



The mechanical monster at top sorts iron, copper, lead, zinc and other useful metals from useless junk in city refuse. Below are some of the odd finds; tweezers point to coin that stopped a bullet

WATCHING amateur "prospectors" pick over the city dump, A. W. Hudson of Los Angeles decided it must be a gold mine of war-precious metals. He determined to mine it. With his chief engineer, Hudson rigged up an ingenious mechanical contraption to sort the thousands of tons of junk, and went into business. The sprawling machine, an arrangement of belt conveyors and magnets and gravity washers, was built entirely from junk parts. A dragline feeds 100 tons of waste materials daily to the main conveyor. The junk rolls into a large drum where it is broken up by rotation and washing—the placer method. A screen separates heavy pieces. The rest is divided into fine and



POPULAR MECHANICS

113 42



Inspecting the final scrap material at the end of the "belt line" sorting system, to hand-pick any gold, silver or aluminum before the unwanted remnants are dumped

rough streams and sent over magnetic fields which pick up iron and steel. The remainder goes into a jig which by gravity sorts copper and lead from worthless mud, glass and the like. Operators watch the stream to hand-pick any gold, tin, silver, aluminum or zinc. The fine-combing process has turned up a profitable bulk of usable metals and a strange collection of jewelry, medals, coins and odd trinkets.



Here is a basket of silverware recovered from the dump to be refined again into usable metal

Below, operators watch the material as it is drawn from the junk pile by the main conveyor



Sorting the scrap iron and steel with a fork as it drops from the endless conveyor

m 5-7-

Two-Prong Tire Remover Avoids Pinching Tube



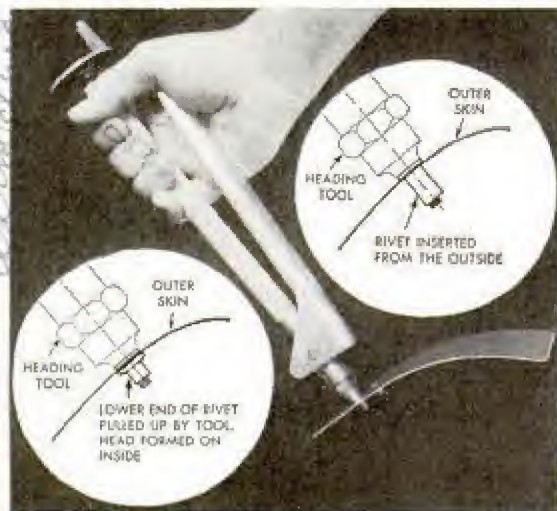
Tool pries tire at two points to avoid pinching tube

Equipped with two prongs spread widely apart, a tool for removing tires helps prevent pinching the tube because it permits the operator to see the tube while he is working. No special skill is required in its operation, and the tool removes tires with the wheel on the car or on the floor.

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Tool Inserts Rivet From Outside And Crimps It by Leverage

For riveting parts which are accessible from only one side, a tool now on the market inserts a tubular rivet into a "blind

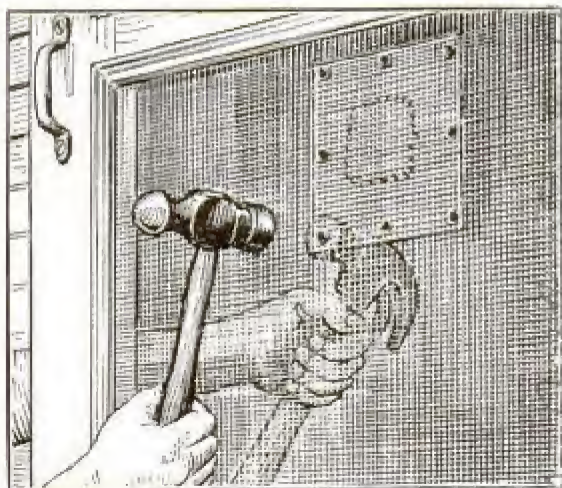


Insets show how tool inserts rivet and forms head

spot" and clinches it without the assistance of other tools. The tubular rivet is threaded inside so it may be screwed onto the mandrel of the tool for insertion into a prepared hole. With the rivet in place, the tool applies powerful leverage which collapses the rivet to form a holding bulge on the inside. The mandrel is then unscrewed from the rivet, the entire operation requiring about 15 seconds.

Patch for Screen Door or Window Fastened by Lead "Buttons"

Torn screens in windows or doors can be mended with little effort by using ready-made patches equipped with lead fasteners. You select the size patch that will



Hammering lead "buttons" clinches patch to screen

cover the break, press the pointed lead "buttons" into the mesh with the fingers, and then pound them with a hammer to make them grip the wires. If the screen is in place, a brick or another hammer may be used as a pounding surface.

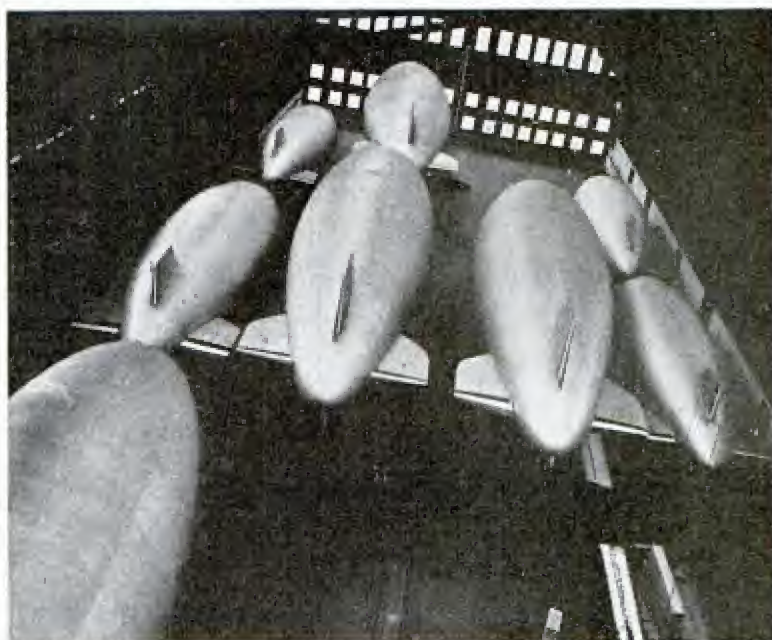
Accidental Deaths Cost Industry 47,000 Workers in 1941

At a time when industrial manpower for war production was one of the nation's most precious assets, accidents in 1941 took the lives of 47,000 workers in the United States—18,000 of them killed in occupational mishaps, 29,000 while off the job. This loss in manpower, the National Safety Council asserts, represented enough labor to build 20 battleships, 200 destroyers and 7,000 heavy bombing planes. The death list among men of draft age, 20 to 45, was

76 57

26,000, sufficient to form nearly two army divisions. The total killed accidentally reached 101,500, exceeded only in 1936 and 1937; the injured numbered 9,300,000, a rise of 200,000 from 1940. One in every 14 residents of the country was disabled by accident during the year. The cost of these accidents was computed at \$3,750,000,000. Highway deaths rose to an all-time high of 40,000, up 16 percent over 1940 although travel increased only 11 percent. On the other hand, industrial deaths were up only six percent while factory employment rose 17 percent and total non-agricultural employment was up nine percent. For the first time in a decade there was no catastrophe which cost as many as 100 lives; a Brooklyn ship and pier fire killed 37 and 36 died in a Maine boat explosion. There were 26,000 deaths from falls.

Squadron of U. S. Navy Blimps Awaits Dawn Patrol



Smaller craft are training blimps, larger are used for patrolling coast

Patrolling the eastern seaboard in a dawn-to-dusk search for enemy submarines is a squadron of U. S. Navy blimps. Between patrols they nest in a big hangar on the New Jersey coast. The blimps carry bombs and machine guns, and, drifting at a slower speed than is possible for airplanes, can maneuver above a suspected enemy craft and drop their "eggs" accurately. Smaller blimps are used for training.

British Seamen Wear "Arctic Visors" on Russian Voyage



Seamen of the British merchant fleet who make regular voyages to northern ports of Russia wear special "arctic visor" masks to protect their faces against the cold and cutting winds encountered along the way. Fitting inside the hood, the mask covers the face leaving only a slit to permit vision. All sailors aboard ships plying the bleak seas receive such masks in their regular kit.

Their faces protected by "arctic visor" masks, these British seamen are ready for icy winds in the far north. Masks are open just enough for vision

How to Make Your Car Do



Examine tires for nails in the treads. They may not cause an immediate puncture, but will result in damage unless pulled out



Now that good oil filters are available, engine oil can be used for long periods without draining the crankcase. However, watch oil condition and replace filter periodically



DURING the first world war, cars two or three years old sold for more than their original cost.

This may happen again, some dealers believe. No new cars are being built to satisfy the normal replacement market, and already used car prices are on their way up. Unless you can afford to pay more for another car you may have to drive your present automobile for the duration of the war. The chances are you will be able to make it last if you take reasonable care of it.

Most of us are accustomed to turning in the "old heap" on a newer car every few years. The old one looks out of date and the new ones have improvements that make them attractive. This habit makes many drivers careless about maintenance, with the result that the average car is ready for the wrecking yard at about 100,000 miles. Most cars can be driven much farther with the right care. Delivery concerns in large cities expect to get upwards of half a million miles out of each vehicle before it wears out.

Since you are going to keep your present car, what can you do to keep it in good shape? Mainly, it's the same old story of proper maintenance. Grease and oil are the two main preservatives of machinery, but grease jobs and oil changes at regular intervals are only part of the story. Modern automobiles require several different kinds of grease and the exact types specified by the factory should be used. The usual greasing doesn't include care of the front and rear wheel bearings or the universal joints. Follow your car manufacturer's or service station's instructions for greasing these parts. The transmission and rear-end grease must be kept at the proper levels and

Smooth-worn tires can be retreaded safely if the carcasses are in good condition

for the Duration

drained and replaced twice a year. Many drivers forget that their shock absorbers need inspection and possible servicing.

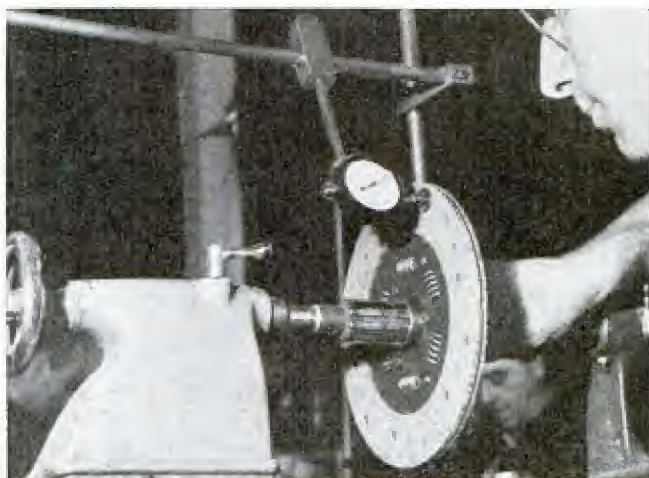
Don't use a heavy oil in the crankcase as long as you can get 300 or 400 miles per quart out of a lighter oil. Heavy oils aren't carried up the cylinder walls as well and excessive wear occurs. Many drivers break in new motors on SAE 10 and use it 10,000 miles, then shift to SAE 20 up to 40,000 miles or more. As a result they drive tens of thousands of miles farther than the average before their motors need expensive ring replacements or reboring. When your engine is rebored, remember that clearances are tight once more and break it in as carefully as if it were brand new. Incidentally, it is poor practice to retard the spark setting so that the engine can use low-octane fuel without knocking. When the spark is retarded the explosion occurs while the piston is on its way down the cylinder, and the film of lubricating oil on the exposed surface of the cylinder is burned off, resulting in tapering wear.

Another important point for long engine life is the gradual warm-up every time you start a cold engine. If you idle the engine until the water temperature approaches normal, instead of working the cold engine hard in traffic, bearings and rings will last a lot longer.

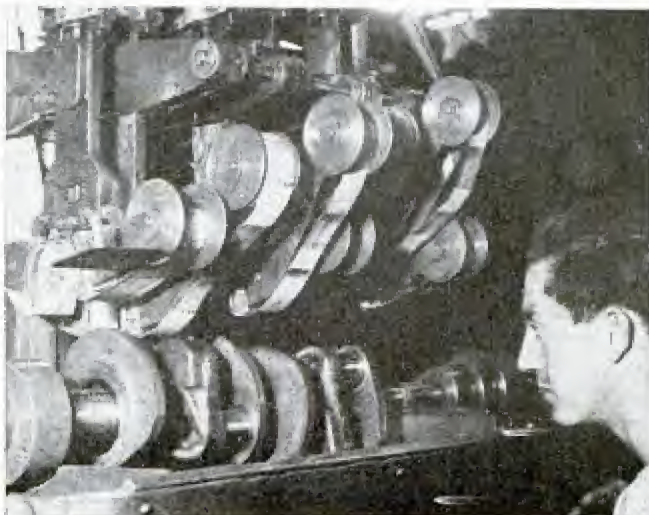
Anticipate trouble, and replace worn parts before they fail. Some drivers make a habit of replacing radiator hose, fuel pump, distributor points, and fan belt every 25,000 miles. At the same time, the carburetor is cleaned out and adjusted. On some makes this servicing should be done more frequently. New spark plugs every 10,000 miles help conserve fuel. It pays to reline brakes before they



Keep your engine clean, using a solvent occasionally to brush the dirt away. The engine that is free of dust and oily grime will run perceptibly cooler in summer weather



Measuring the accuracy of a new clutch facing that is to go into a rebuilt car. In driving, keep your foot off clutch pedal except when shifting gears and you'll save much wear



This polishing machine is putting a fine finish on the bearing surfaces of a crankshaft



Top, headlight-testing "bomb" fits against headlight to measure its output of light. Below, bathe the air filter in gasoline every few thousand miles, then dip it in light oil



reach the point where every stop is a gamble; for one reason, by that time the drums are probably scored and warped and must be turned down on a lathe.

On most cars the fan belt also drives the generator and water pump. The bearings of these two accessories wear out rapidly if the belt is too tight. Keep it loose enough so that you can push it sideways back and forth about an inch.

Ask a mechanic to check your clutch pedal for proper clearance. Keep it supplied with clutch oil if it is of the wet type. Keep gears in neutral at traffic stops instead of waiting for the green light with clutch depressed, and keep your left foot entirely off the clutch pedal except when shifting gears. The release bearing and pressure plate of the clutch wear out prematurely from such habits.

Have your battery checked occasionally, keep the liquid level up with distilled water, and keep the terminals clean. Use ordinary baking soda mixed with water to wash them, then apply vaseline or cup grease. To keep your radio in good shape, never start the engine while the radio is turned on.

Engine efficiency depends partly on its temperature. Test the radiator water with a thermometer after you have gotten engine heat up to normal by driving it a number of miles. If the water temperature is below 160 degrees or above 180 degrees the thermostat may not be working properly and should be replaced. Too high a temperature may mean the circulating system is clogged with rust or with rubber that has peeled off old radiator hose. Use a rust inhibitor in the radiator to keep it rust-free.

Most drivers can get mechanical repairs and rebuilding done better and cheaper at a reliable garage than they can do it themselves. Modern automobiles are

Telephone receiver on end of metal rod tests rebuilt engine block for vibrations

too complex for unskilled hands and for most operations special tools are necessary.

If you own a Ford, Chevrolet, or Plymouth you can replace a worn-out engine with one rebuilt to factory specifications, at a cost of \$50 to \$75 in most parts of the country. Such a replacement will give new-engine economy and dependability. At such rebuild shops as the one operated by Louie Meyer, ex-Indianapolis race winner, the old engines are completely torn down and cleaned, valve seats are reground or replaced, connecting rods are reconditioned, cylinder sleeves are replaced with new ones, and new pistons, rings, pins, bushings, and bearings are installed. Reconditioning of the carburetor, fuel pump, distributor, and clutch, are extra items and should be done at the time the old engine block is exchanged for a rebuilt one.

Some replacement parts may be hard to get for a time and if your dealer can't supply you the next best bet is a wrecking yard. Parts bought at such places may have had a lot of wear but a worn gear is still better than a broken one. Not all cars in a wrecking yard may be worn out; many new models that have been wrecked may be found there and if your upholstery is worn or the seat springs are sagging you may be able to replace them with material that has had much less use.

Everybody would like high gasoline and tire mileage. Common sense driving will give it to you. Keep the engine adjusted for maximum power but never use all of it. Fast acceleration uses a lot of fuel and a gallon will carry you farther if you accelerate slowly and shift into higher gears at lower speeds. Take your foot off the accelerator as soon as you see a signal set against you. Drifting up to a red light instead of dashing

(Continued to page 169)

Rust inhibitor poured in radiator prevents damage from rust that may clog passages.



Loose front-axle bearings can be detected by trying to jiggle wheel; repack bearings every 5,000 miles and keep tight

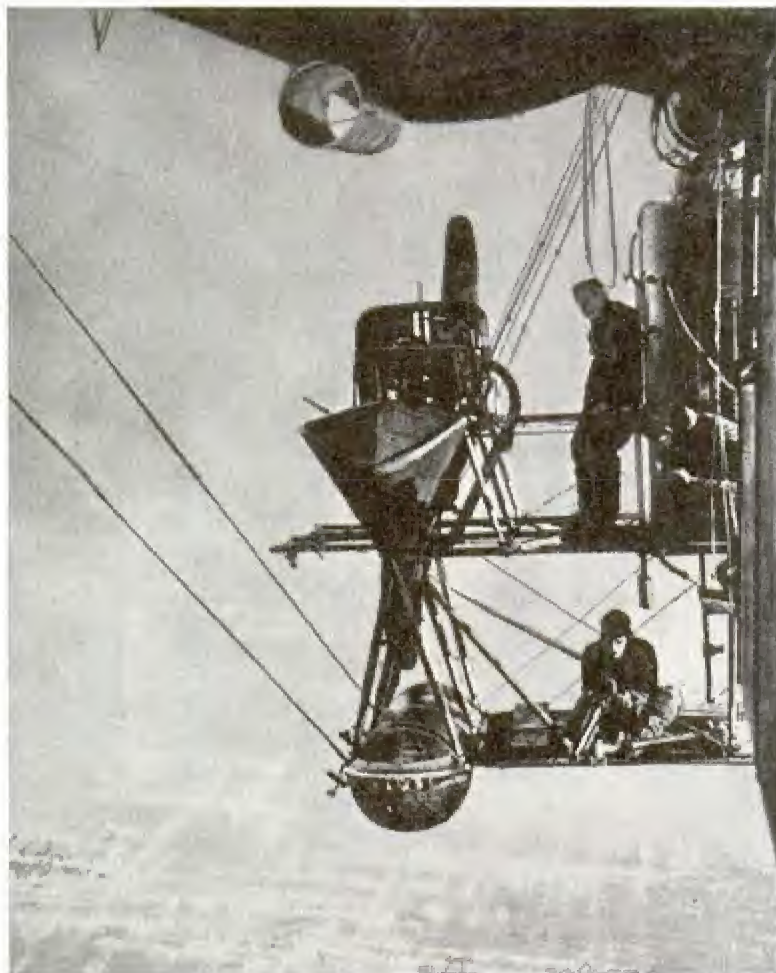


American Airlines photo

Clean spark plugs and proper gaps aid efficient engine performance. Above, inspecting plug for oil and gap measurement



Dirigible Gunner on Open Deck Ready to Blast Enemy "Sub"



Alert for the appearance of a submarine, gunner keeps finger on trigger

British dirigibles stalking Nazi submarines from the air maintain a never-ending lookout to bag their stealthy quarry. One of the gunners, stationed on an open platform of the lighter-than-air craft, is shown here alert for the moment when he can open fire on an undersea boat.

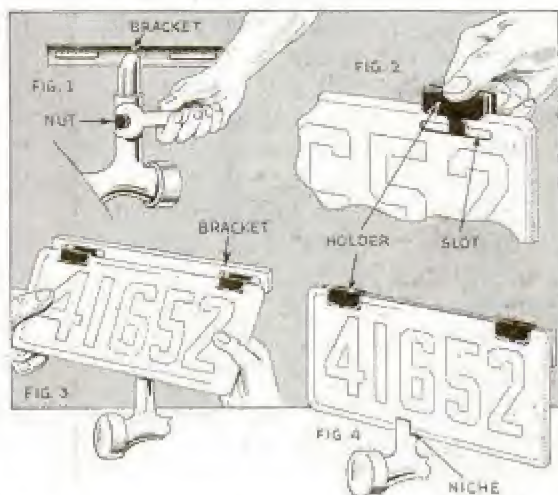
Rubberless Wheel May Return As Last Resort in Country

If the rubber shortage continues, it is barely possible that the rubberless wheel with springs and shock absorbers will be tried again, at least on farm vehicles and passenger cars in rural areas. It would not be smooth-riding nor permit high speeds, and rubberless wheels are forbidden on most paved streets and highways. Furthermore, it would be complicated and expensive and could not compete with the

most inferior small rubber tire. However, there was a big crop of spring wheels in the early days of the automobile, when pneumatic tires were going flat too often for pleasure, and it is possible a "hard" wheel may be developed should the rubber famine persist.

One-Piece Holders For License Plates Need No Bolts

No bolts or nuts are needed in attaching automobile license plates when new one-piece, S-shaped holders are used. One end of the S-hook is inserted pointing upward into one of the slots in the license plate bracket, and the other end, pointing downward, should be inserted into the corresponding slot in the license plate. Two holders are used for each plate, and after they have been put in place, the bracket, with the nut loosened, is forced downward until the bottom of the plate is fixed firmly in the V-shaped niche at the bottom of the bracket.



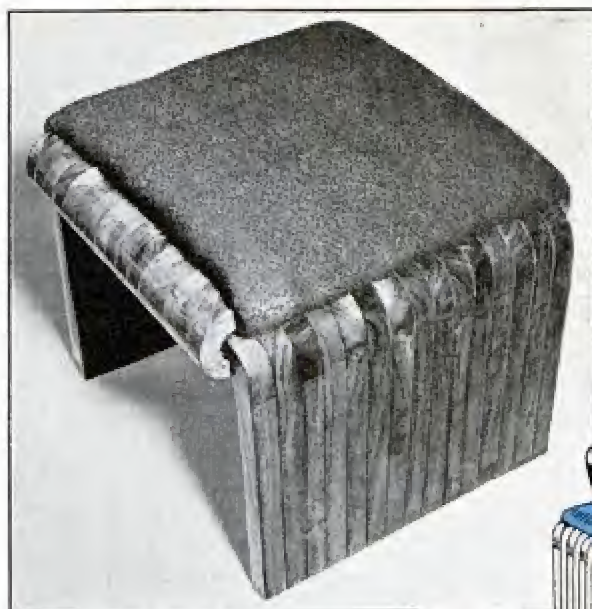
Figures 1, 2, 3 and 4 show how holders are applied

POPULAR MECHANICS

Aurora Equipment Co.



The CRAFTSMAN



Sturdy, Padded **FOOTSTOOL** *in modern lines*

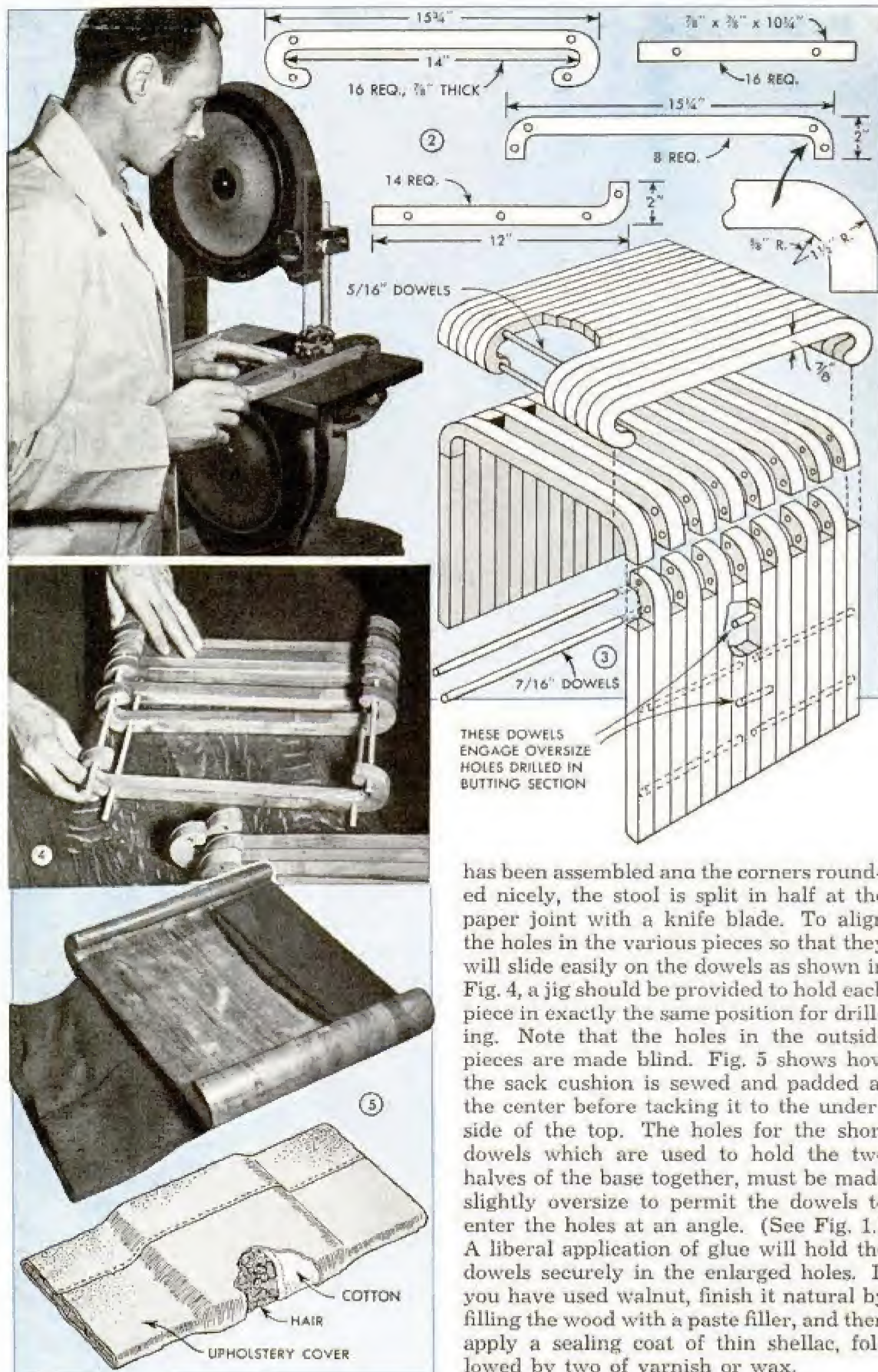
By Benjamin Nielsen

PUZZLING until you know the trick of interlocking the top to the base, the unusual construction of this attractive footstool is sure to intrigue your friends. Fig. 1 shows how it is done by making the base in two parts and then gluing and doweeling both together after slipping them under the hooked ends. As the top thus becomes an integral part of the stool, the tacks holding the cushion must be so spaced to be accessible through the slots in the top of the base, otherwise you will be unable to renew the cushion.

It is best to cut all the pieces comprising the base of the stool from one board of uniform thickness so that the ends will fit



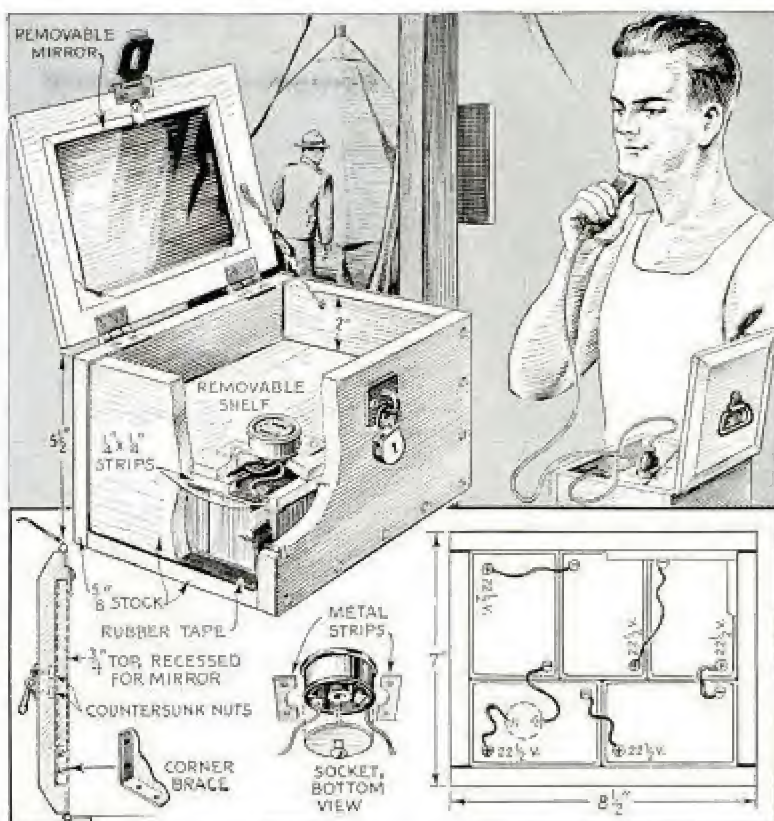
snugly at the corners. Fig. 2 gives the size and number of pieces required, while Fig. 3 shows where they go. The pieces making up each leg are doweled and glued together in two separate sections, after which both are glued together with a strip of heavy paper between the joint. This permits each leg to be held temporarily in one piece for sanding. After the complete base



has been assembled and the corners rounded nicely, the stool is split in half at the paper joint with a knife blade. To align the holes in the various pieces so that they will slide easily on the dowels as shown in Fig. 4, a jig should be provided to hold each piece in exactly the same position for drilling. Note that the holes in the outside pieces are made blind. Fig. 5 shows how the sack cushion is sewed and padded at the center before tacking it to the underside of the top. The holes for the short dowels which are used to hold the two halves of the base together, must be made slightly oversize to permit the dowels to enter the holes at an angle. (See Fig. 1.) A liberal application of glue will hold the dowels securely in the enlarged holes. If you have used walnut, finish it natural by filling the wood with a paste filler, and then apply a sealing coat of thin shellac, followed by two of varnish or wax.

Small Power Pack to Operate Electric Razor

Designed and used by a soldier to operate his electric razor while on maneuvers where electric current was unavailable, this power pack will also be found useful by others. It consists of a wooden box containing five radio B-batteries. In this case, the box was of a size to accommodate five BA-2's, radio batteries used in communications units. But any B-batteries available can be used by making the box to suit. The batteries are wired in series and are connected to an outlet plug, which was mounted on a removable shelf that covered the batteries and provided a compartment for towels and shaving accessories in the upper part of the box. A removable mirror was recessed into the lid where it was held by a spring clip at the top and corner braces at the lower corners.—N. R. Arluke, Trenton, N. J.



Stripes on Open Garage Doors Caution Other Drivers

If your garage is located along a narrow alley where only a small space is available for turning, it's a good idea to paint black and white stripes on the inside of each door. This will serve as a warning for other drivers in the alley, especially at night, that the doors are open.



Pegs in Colonial Floor Simulated By Ringed Punch Depressions

When remodeling their homes, many owners like to imitate the old colonial pegged type of floor in at least one room. Often this is done by covering the floor with random width boards and providing false pegs. An easy way to simulate the pegs is to use a short piece of $\frac{1}{2}$ -in. pipe as a punch to make ringed depressions in the boards at the desired locations. The inside surface of the pipe is beveled at one end to produce a sharp edge. The centers of the depressions are stained slightly darker than the rest of the floor, thus making the simulated pegs stand out.



Solving HOME



PAPER SACK

3



POTATO

4



POTATO MASHER

5



1



PERCOLATOR

2

1—You'll find it easier to cut canned pineapple into uniform pieces of the desired size if you do it while the slices remain whole in the can. Simply pass the knife through the hole in the fruit and cut outward from the center, holding the knife vertically

2—Asparagus can be cooked extra tender for serving stalk length by placing it with the tips up in the boiler of your percolator. Cut the stalks to fit inside and then add boiling water to a level just below the tips. Don't forget to first scour the percolator well

3—Threads, bits of cloth, etc., can be kept from littering the floor beneath the sewing machine by attaching a paper sack to one end in which to drop the scraps. Tabs of cellulose tape make it easy to remove the sack without marring the finish of the machine

4—Instead of going to all the trouble of getting out your polishing equipment every time you notice a piece of silverware tarnishing a little, just rub it with a freshly cut raw potato dipped in salt to remove the slight discoloration in a jiffy



NAIL

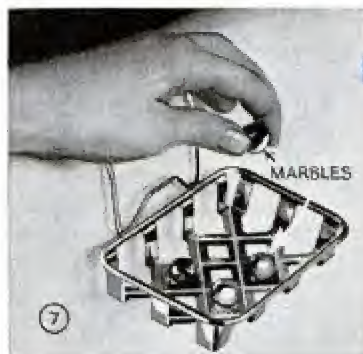
SPRING CLOTHESPIN

6

5—Your hands will not smart, and there's less chance of tearing dainty articles of clothing while dry-cleaning them if a wire potato masher is used as a plunger to gently force the liquid through the cloth

6—When you want to leave the lid on a cooking vessel partially raised to emit steam, a spring clothespin and nail clipped to the edge of the pan as shown, provide a convenient support for the lid

PROBLEMS



7—Soap will not have a chance to harden in the bottom of a metal soap dish and thereby become difficult to remove, if you put four glass marbles in the dish as shown to keep the bar from touching the bottom



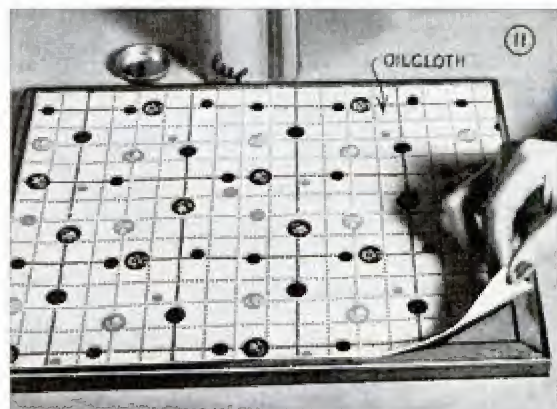
8—Don't make another hole in the wall behind a picture when the nail supporting it becomes loose. Instead, make the nail solid again by dipping cotton in glue and wrapping it around the nail before replacing it in the enlarged hole as shown



9—Squatting to search for utensils stored on low shelves in a kitchen cabinet will not be necessary if the shelves are replaced with a deep plywood bin as shown. This can be pulled out like a drawer for easy selection of the utensils from a standing position



10—Several layers of adhesive tape wrapped around loose coil ties of an uncovered bedspring having a wire framework, will prevent the possibility of catching and tearing the mattress or bedclothes on the sharp ends of the wire coil ties

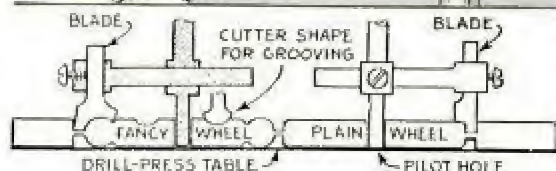
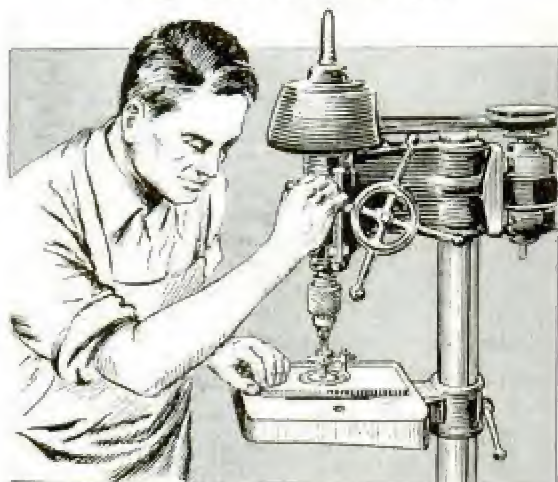


11—Entrance of moisture and dust in framed pictures can be minimized by sealing the backs with oilcloth. Cut it slightly smaller than the frame, coat with glue and press it down in place with the glossy side out



12—Less effort is required to polish a waxed surface if you make use of the weight and convenient grip of an electric iron. Flannel is a good polishing material to use to obtain a high luster quickly

Easy Way to Form Toy Wheels On Your Drill Press



Toy wood wheels can be cut and shaped in one operation on a drill press by using your disk-cutting attachment. The cutting blade for this work can be shaped from an old wood chisel or other suitable piece of steel. The shape of the cutting edge will be determined by the desired shape of the wheel to be cut. As indicated in the lower details, the stock from which the wheel is made is cut halfway through from one side, then it is turned over and the cut is completed from the other side.

Ventilator Shields Work on Desk In Front of Open Window

If you have trouble with the wind scattering papers on your desk because it is directly in front of a window, the difficulty can be overcome easily with an adjustable window ventilator of the type shown. It is



either fastened on the desk top permanently or fitted with two flat-iron brackets on each end to hold it vertically without being screwed in place.

Thimble Holder and Protector For Points of Scissors

Slipped over the end of a pair of scissors, a rubber stopper protects the pointed ends and, at the same time, serves as a holder for a thimble. This idea is especially handy when sewing accessories are kept loosely in a drawer as it prevents injuring the hands on the scissors and keeps the thimble where it can be found easily.



V-Notch in Side of Garden Hoe Removes Tough Weeds

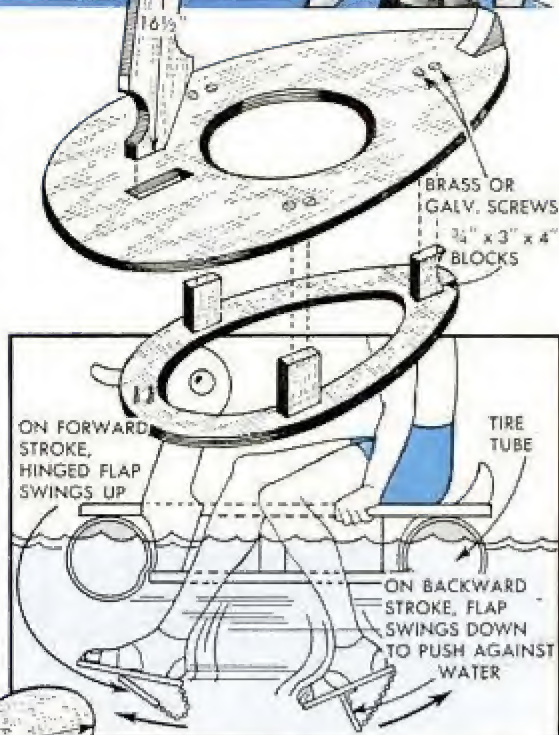


Sprouts and tough weeds may be chopped off more easily with a garden hoe if a V-notch is cut in one side of it and both edges sharpened. Cutting action is improved by the two sharp edges being in the shape of a V and the hoe will not slip off once the weed is in the notch. Also, these edges stay sharp for a considerable length of time as they are not in the ground constantly where small stones tend to dull cutting edges quickly.

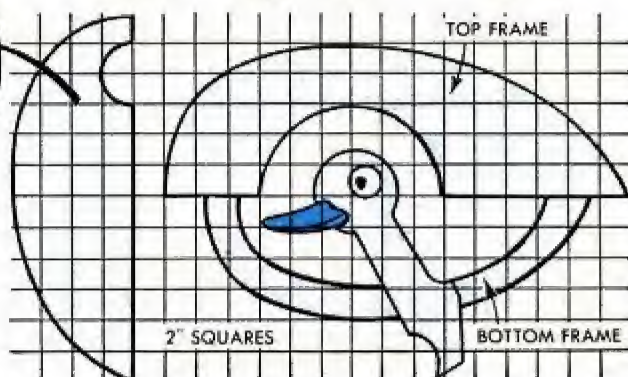
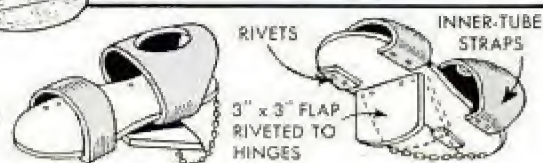
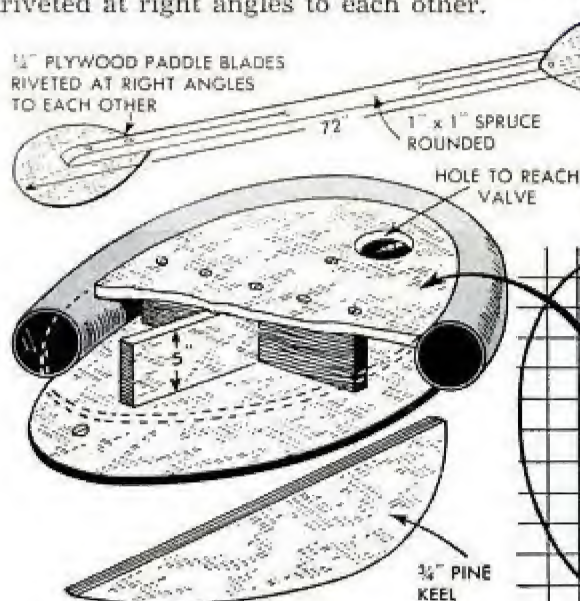
FUN *with these* BATHERS' FLOATS



YOU won't have to worry about tight seams when building these beach floats as buoyancy is provided by old auto inner tubes that fit in place snugly when they are inflated. Legs on the floating duck are supplied by the passenger who propels himself forward with special water sandals. The frame and head of the duck are made of tempered hard-pressed board. The paddling sandals, made of the same material have soles with hinged flaps on the bottom and rubber straps riveted on the sides to hold them in place. The other float is simply a large inner tube stretched over a frame having a streamlined top and bottom. A wood fin screwed to the bottom serves as a keel and a hole in the top provides access to the valve so that the tube can be inflated after it is in place. Paddles are made easily as shown, the blades being riveted at right angles to each other.



1/2" PLYWOOD PADDLE BLADES
RIVETED AT RIGHT ANGLES
TO EACH OTHER



Lantern Held Safely on Boat Deck By Rubber Clips at Base



To hold a lantern in a vertical position on a boat deck, one sportsman uses rubber clips tacked to the deck so that they overlap the flange around the base of the lantern. When not needed, the clips can be removed without marring the deck to any great extent.

Chair Back Keeps Heavy Quilts Off Feet of Patient

To keep heavy bed clothing from pressing on the injured feet of a patient, one nurse often employs a chair back. The ends of the quilts or blankets are drawn around the chair and pinned in the manner shown.



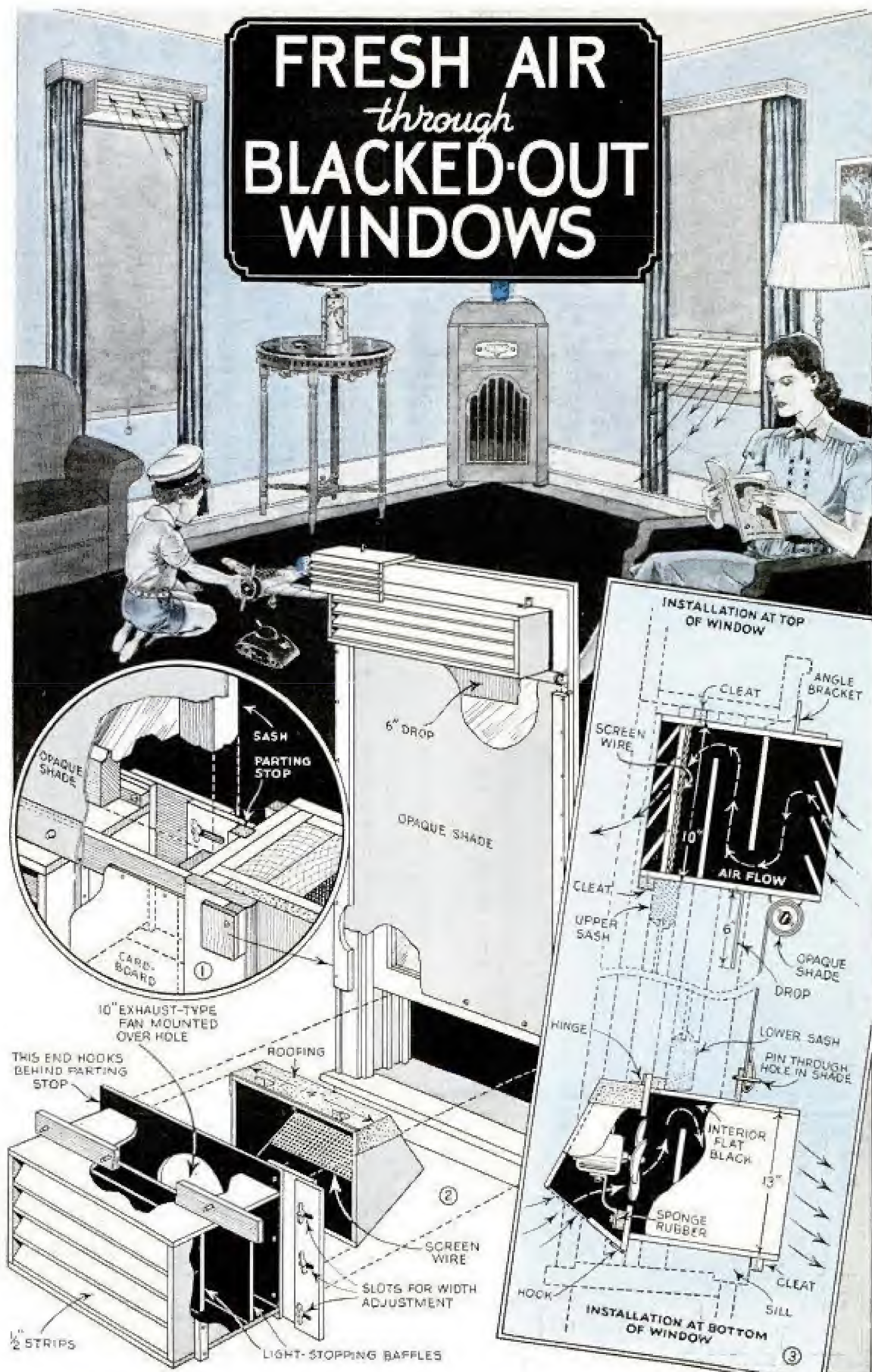
Forced-Air Units Ventilate Home During Blackout Periods

With these simple forced-air units, you can keep one or two rooms well ventilated on warm nights when your home must be closed tightly during blackout periods. Where possible, the unit containing the fan is located at the bottom of one window to draw in air from the outside, and the other unit is located at the top of a second window to permit escape of air. If only one window is available the units are located at the top and bottom of it. Each unit consists of a wood box open at opposite sides, and made to fit snugly into an opening, which is provided by raising or lowering the sash. In Fig. 3, notice that the upper unit is held in place by angle brackets screwed to the window trim, cleats being screwed to the top of the unit to fit snugly against the sash parting stop and to the underside to fit against the lowered sash. An opaque shade to black out the window is suspended from this unit with a 6-in. drop between it and the sash to help trap any light that might escape around the shade roller. The shade slides in grooves provided by screwing wood strips to the window trim as in Fig. 2. The lower unit rests on the window sill and has an adjustable wing on one end to fit behind the parting stop, Fig. 1. The fan-mounting board projects to fit behind the sash and a strip is provided in front on which to hook the bottom of the opaque shade. Each unit has two baffles inside to serve as light traps. The upper one has louvers at the open sides for the same purpose. A screen behind the louvers at one side keeps out insects. The lower unit has louvers at the inner side only. The side that projects out of the window is fitted with a hoodlike frame having a screened opening on the underside to prevent rain and insects from being drawn in when the fan is running.

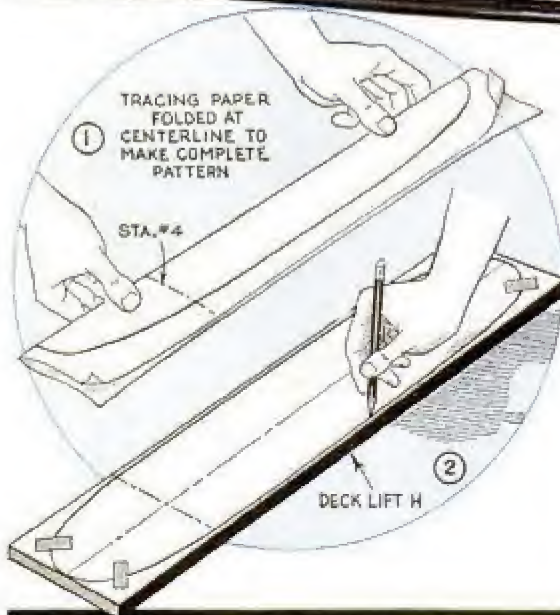
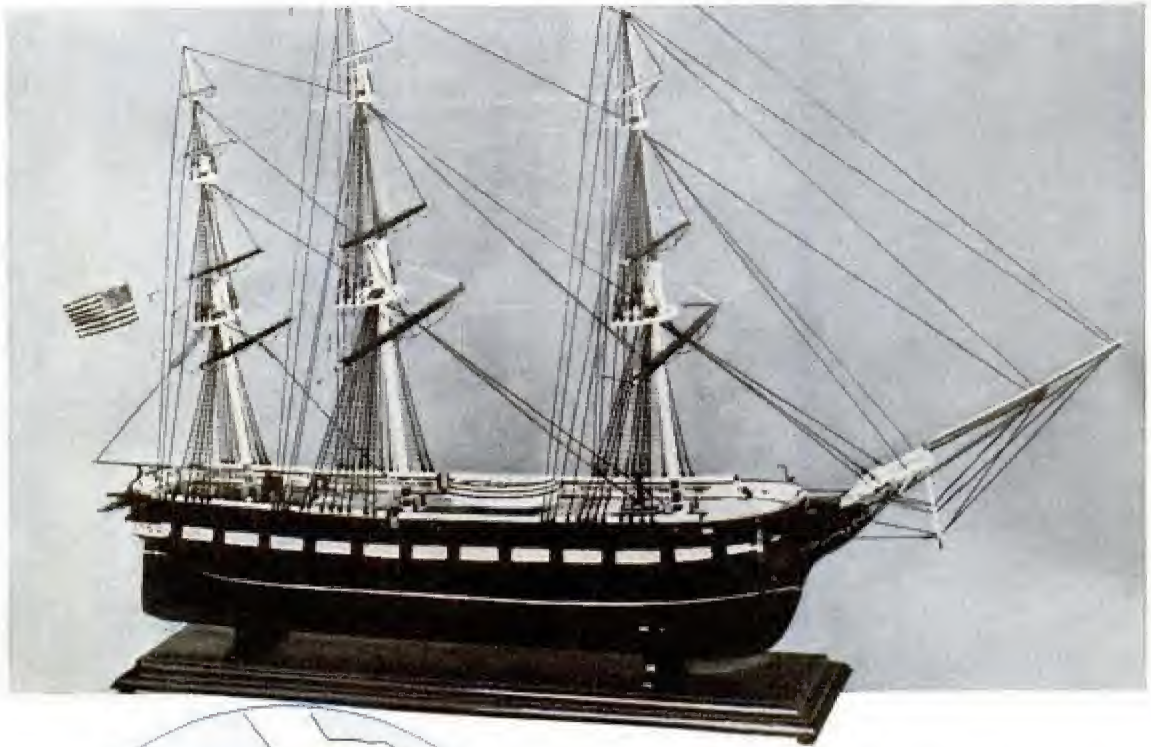
Selecting a Complementary Color

When selecting paint for finishing pieces of furniture or for decorating a room, good use may be made of the optical method of determining the complementary of a given color. Look at a sample of the color for about 30 sec. Then shift your gaze to a white surface. The after-image that appears is the complementary color. For example, the after-image of yellow is violet.

FRESH AIR *through* BLACKED-OUT WINDOWS



Model of U. S. Frigate

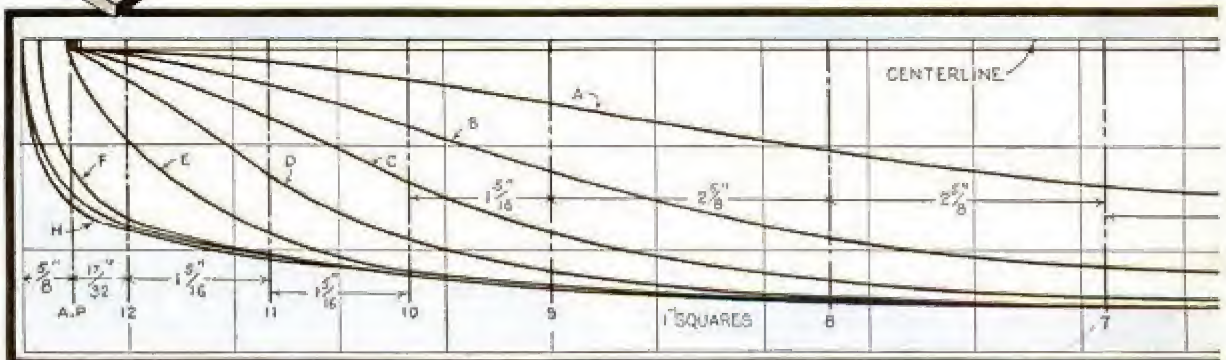


By H. W. POTTER

Part I—Building the Hull

WITH no difficult superstructure or ornate carving to overtax your patience, "Constellation" is a comparatively simple model to build. Its trim lines and striking coloring of black, white and gold make it a truly beautiful mantel piece.

To model this historic warship, you begin by making full-size paper patterns of the eight lifts or boards that form the hull. This is done by ruling paper in 1-in. squares and drawing in lines at points corresponding with the half-breadth patterns

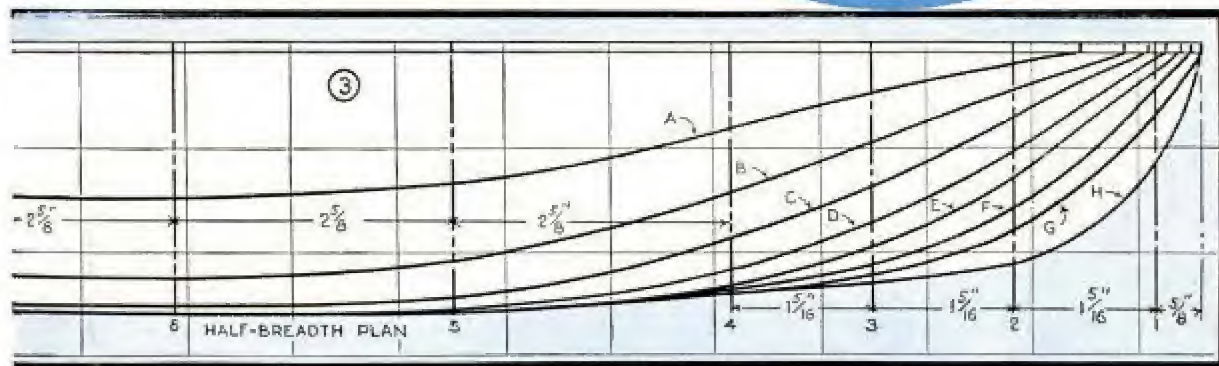


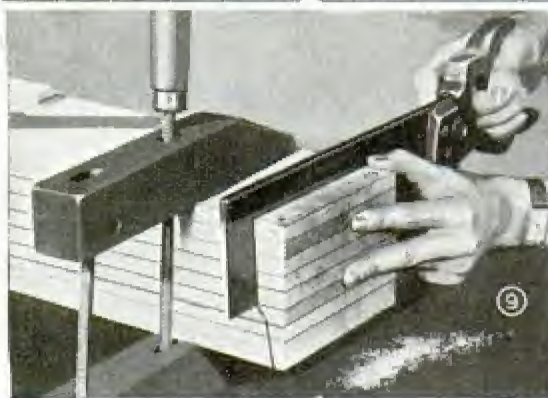
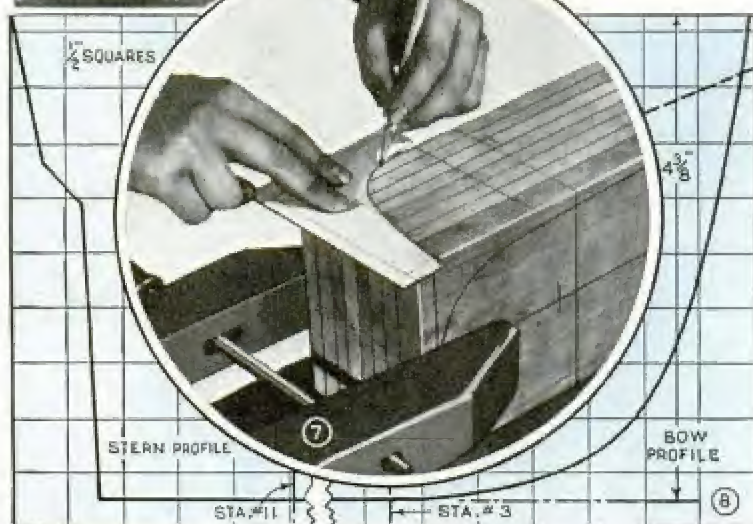
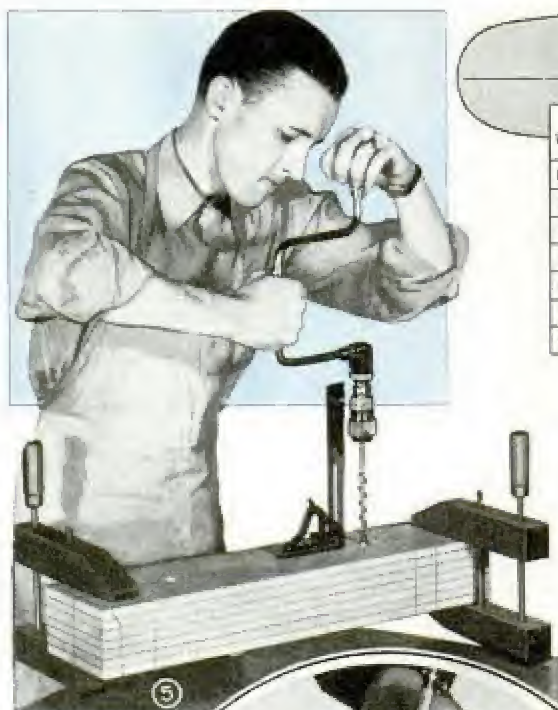
"CONSTELLATION"

Recommissioned in August, 1940, as a part-time flagship for administrative purposes, the historic frigate "Constellation" is now the oldest U. S. warship afloat. It was originally launched September 7, 1797, 45 days before the "Constitution," the only other survivor of the original six ships comprising the first U. S. Navy. Manned by a crew of 12 officers and 300 men, the "Constellation" was armed with 38 guns. It was rated at 1,265 tons, had a 40-ft. beam and a 163-ft. length from stem to stern. The cost of building this ship was \$314,212

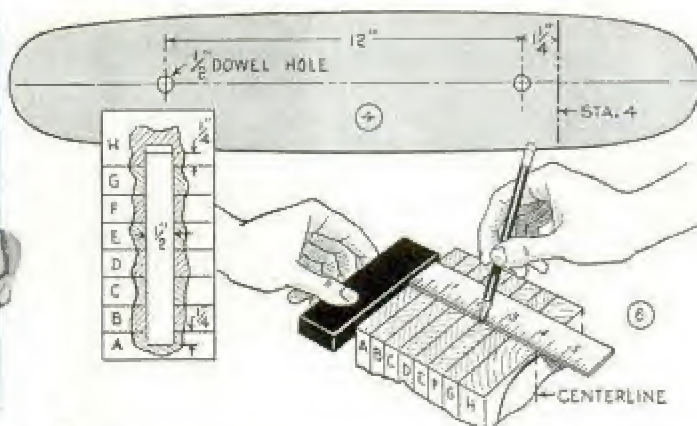


given in Fig. 3. Enlarge just half of each pattern in this manner, marking in station line No. 4, and then fold the paper at the center-line as in Fig. 1 to duplicate the opposite half. Of the eight lifts required, seven of them are of $\frac{1}{2}$ -in. clear white pine, the deck lift being cut from a piece of $\frac{7}{8}$ -in. straight-grain gumwood as this simulates closely the appearance of a weathered deck. In selecting the white pine be sure to see that it measures a full $\frac{1}{2}$ in. thick as the eight lifts must total exactly $4\frac{3}{8}$ in. when stacked together. Cut your wood into pieces measuring $5\frac{1}{2}$ by 23 in. and square station





Differing from the usual procedure of shaping the bow after the lifts are cut to shape, here it is done beforehand so that the stacked lifts will provide a flat surface on which to mark the profile as in Fig. 7. The stern is shown being cut in Fig. 9



line No. 4 across the face of each. Next, you mark lift G with a centerline and locate the points for boring the two dowel holes as indicated in Fig. 4. The dowels are provided to prevent the lifts from shifting out of line when gluing and clamping them together. Letter the lifts alphabetically as indicated, stack the seven pine lifts and

clamp them together temporarily with a couple of handscrews. If you must bore the holes by hand, use a try square as in Fig. 5 to keep the bit running as straight as possible. Note in the cutaway detail of Fig. 4 that the holes enter lift A only part way. To bore corresponding holes in line in the underside of the deck lift, you clamp lift G to it and use the holes in the lift as a guide for the bit. After you have the lifts bored and fitted with dowels, run a centerline the length of lift

H, mark its shape as in Fig. 2 and square the centerline down each end of the stacked lifts as in Fig. 6. By locating the centerlines of the lower lifts in this manner instead of marking each individually beforehand, any error made in boring the holes straight will not offset the centerlines. Now, each lift can be marked for shape from its respective pattern. Center the patterns with the marks on the ends of the lifts and keep station lines No. 4 in register. After this, square all thirteen station lines across the top of lift H, spacing them as indicated in Fig. 3, and then extend Nos. 3 and 11 down one side. It will be easier to mark and cut the bow and stern profiles if you do it before sawing out the lifts, as a

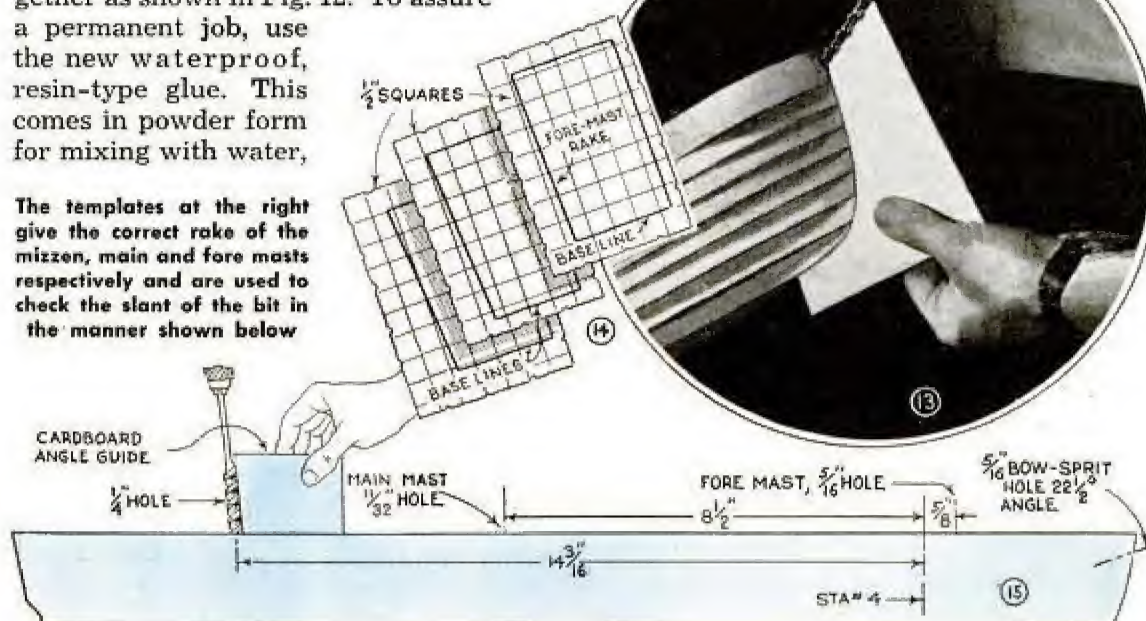


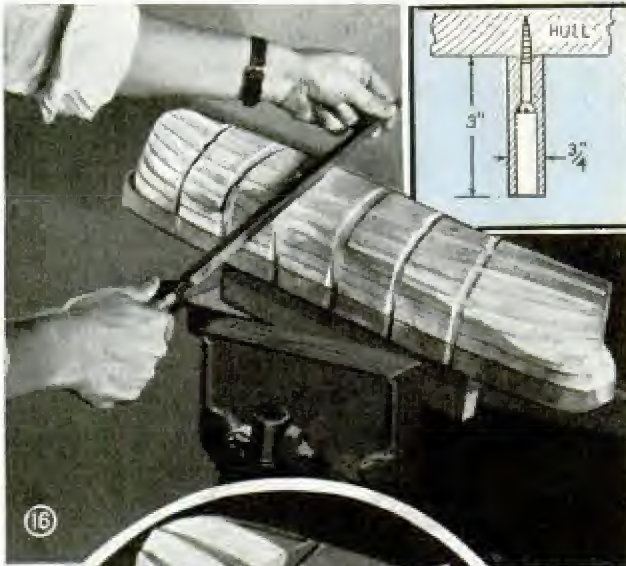
flat surface will be had to work from. Fig. 8 gives patterns for the profiles, although, if you wish, the bow profile can be obtained by tracing the full-size stem pattern in Fig. 23 and extending it to the top of the deck. (See Fig. 7.) The stern profile is placed even with station No. 11, while the bow begins at station No. 3. Both ends can be cut with a handsaw, the stern as in Fig. 9 and the bow by taking several tangent cuts and finishing with a wood rasp. The general contour of the hull is obtained by sawing each lift to shape as in Fig. 11 before gluing the lifts together. This is known as the bread-and-butter method of construction and simplifies greatly the carving of the hull. At this stage the hull should look like Fig. 10.

You are ready now to glue the lifts together. The dowels make it a simple job as there is no need to worry about misalignment of the lifts. The important thing here is to see that all contacting surfaces are evenly coated with glue and clamped tightly together as shown in Fig. 12. To assure a permanent job, use the new waterproof, resin-type glue. This comes in powder form for mixing with water,



The templates at the right give the correct rake of the mizzen, main and fore masts respectively and are used to check the slant of the bit in the manner shown below



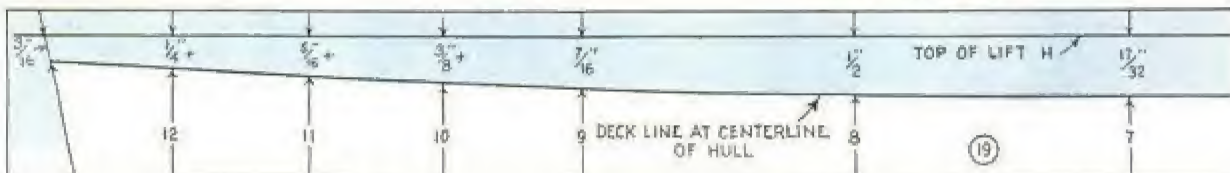
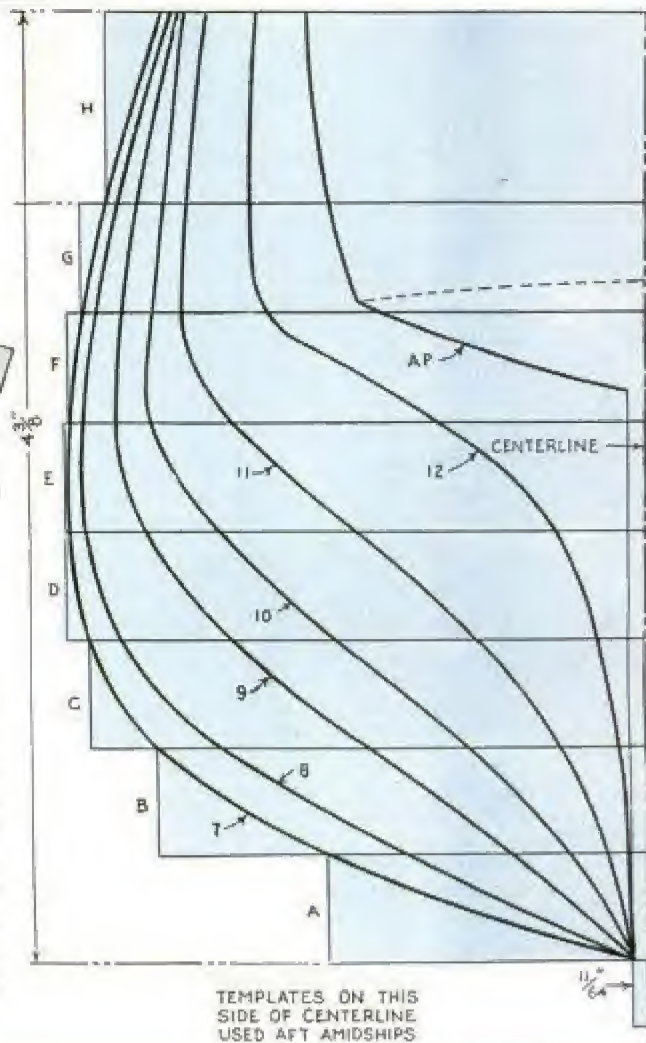


and as the glue cannot be used after it stands, mix only an amount sufficient to do the work at hand. Allow the lifts to remain clamped over night.

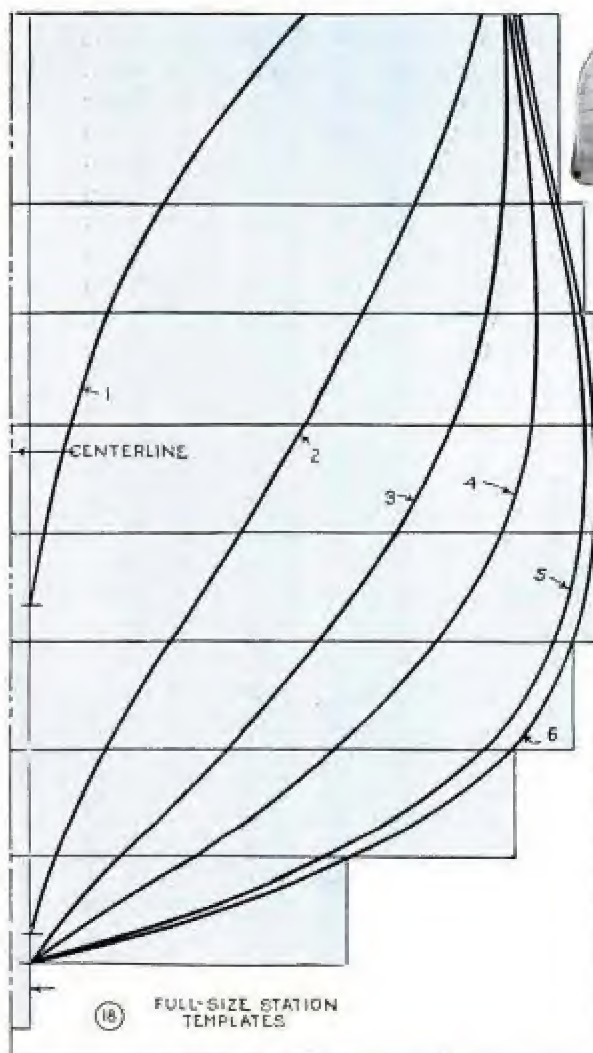
If the mast holes are to be bored by hand, the templates given in Fig. 14 can be used to check the angle of the bit. It is best to bore them now while the deck is flat so that a try square can be used to plumb the bit laterally. The mizzen, main and fore masts have an aft rake or slant of 5, 3 and 2 degrees respectively and are located on the centerline in the position indicated in Fig. 15. The dotted line on the profile pattern (see Fig. 8) represents the point where the bow is bored for the bowsprit. It is not nec-

essary to make another template as you can use the original to check the angle as in Fig. 13.

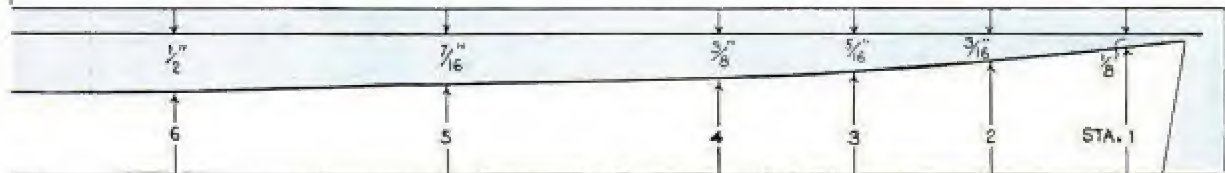
Now make up a set of body templates or molds from the half breadths in Fig. 18. All thirteen of these, including the after perpendicular (A.P.), are given full size so that all you have to do is to trace each line separately on stiff cardboard or thin plywood. These lines represent what the hull would look like if it were sliced like a loaf of bread at each station line. Cut out each template carefully so that its outside shape will look like the one shown to the right of Fig. 17, and



number it. To enable you to hold the hull upside down in a vise for carving, fit the deck with a clamping "keel" as shown in Fig. 16. If the screws are placed in the piece to enter the deck midway between the masts, the deck fittings will later cover the screw holes. Now, starting at station No. 7, for example, begin removing the waste with a coarse file as in Fig. 16. As you file, check the progress frequently with the body mold for that particular station as in Fig. 17. To obtain a true check each time, you must hold the top edge of the mold squarely and in contact with the top of the deck. When the contour of the hull begins to approach that of the body mold, work carefully to avoid filing too deeply. By rubbing the edge of the mold with graphite or blue chalk, you can tell quickly where the hull needs filing to make the mold fit perfectly. Proceed to work the hull down

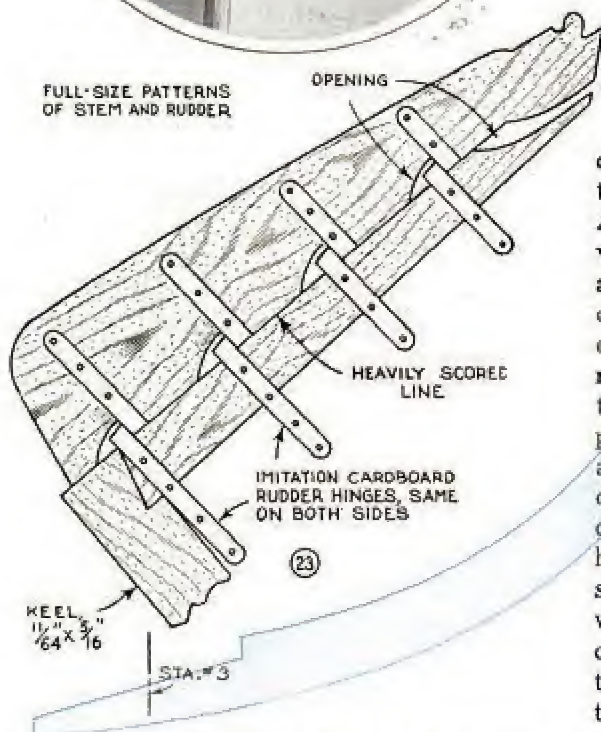


at stations 5 to 10 inclusive as in Fig. 16 until the leading edge of the mold meets the deck centerline, and then with a small block plane, remove the waste between the grooves. The shaping of the bow and stern requires the use of a half-round file and a gouge to cut the flare. Be particularly careful in shaping the bow so that you do not spoil the rounded end of the top lift by filing beyond the edge. Also, do not bring the bow or stern to a decided point, but leave a flat





FULL-SIZE PATTERNS
OF STEM AND RUDDER



By placing carbon paper under these full-size patterns of the rudder and stem, or thin paper over the top of them, you can trace their exact shape either directly to the wood, or first to cardboard. Use hardwood, especially for the stem, and drill pilot holes for the brads to avoid splitting the pieces in attaching them. The rudder and its post are made to look like two separate pieces by scoring each face

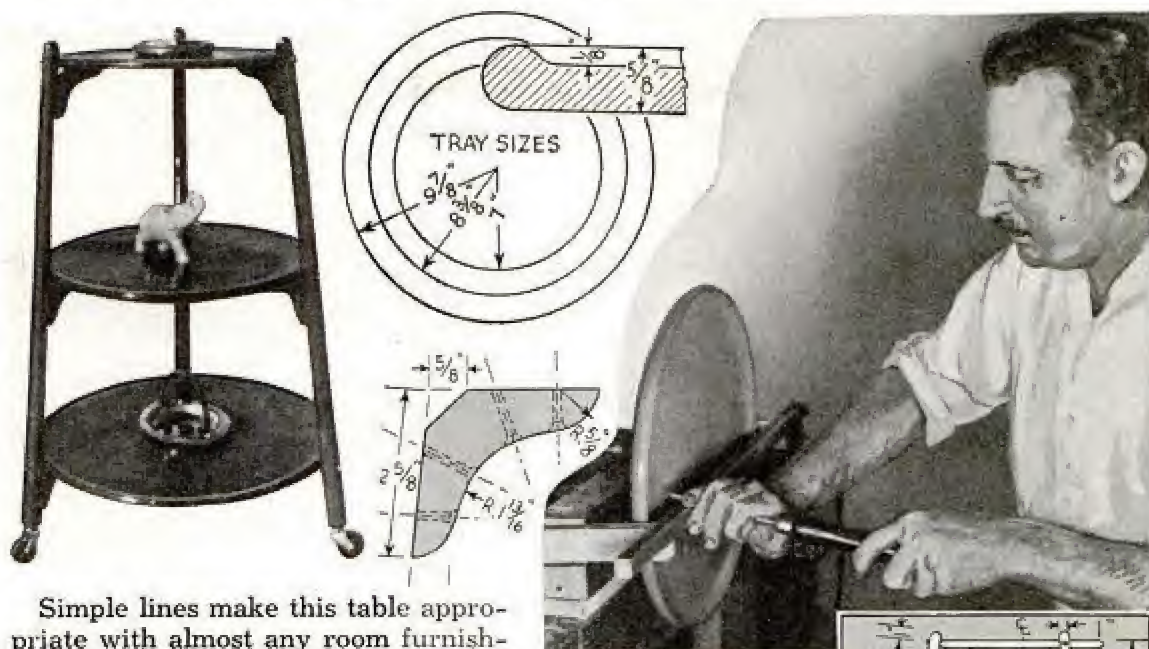
spot for attaching the stem and rudder. Final shaping and sanding of the hull at these points is done after the stem and rudder have been attached.

With the hull carved, the next step is to curve the deck from bow to stern. Before you do this, however, transfer the position of the station lines to the side of the hull so that they can be re-marked on the deck later. Fig. 19 shows the amount to be removed at each station line. An easy way to do this is to kerf the deck with a handsaw as shown in Fig. 20. Make saw cuts about $\frac{1}{4}$ in. apart to a depth slightly above the guide lines marked on both sides of the hull, and then chip away the wood with a chisel. Follow this by planing across grain to bring the deck down to the right depth. After you have the deck curved lengthwise, it is crowned $\frac{1}{16}$ in. laterally. For this, a cardboard template will be needed to check the crown as you slope the deck each way from the centerline with a cabinet scraper. With this done, re-establish the station lines on top of the deck. Complete the hull by adding the stem, rudder and keel as in Fig. 21. Both stem and rudder are given full size in Fig. 23 for tracing directly on the wood. It is best to use hardwood for these parts, especially the stem as most of this is cross grain. You will notice that the rudder and its post are cut from one piece but made to look like two separate pieces by scoring the wood at the point indicated. Brads and glue are used to attach the parts as shown in Fig. 22, after which the keel is fitted between the two. The false hinges which pass through the openings in the rudder and glue to each side, are attached after the final sanding of the hull.

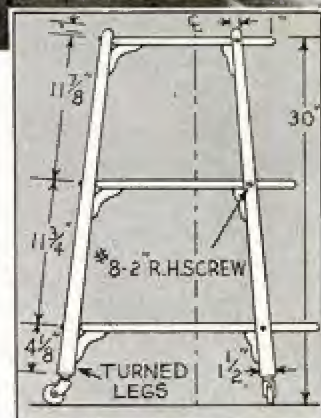
(To be continued)

POPULAR MECHANICS

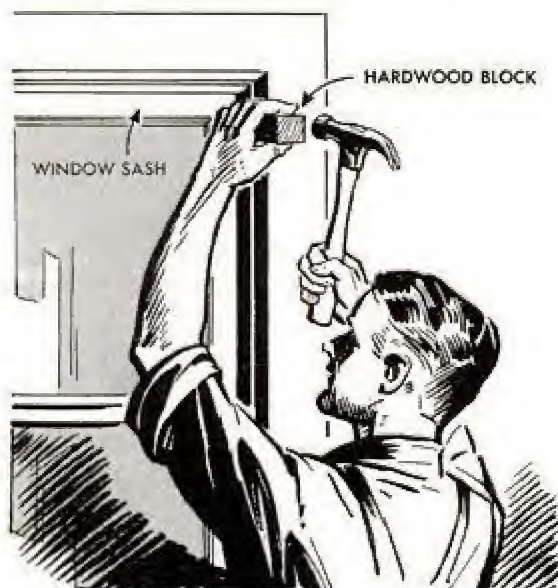
Three-Tray Table on Casters Has Many Uses



Simple lines make this table appropriate with almost any room furnishings, and its versatility makes it almost indispensable to the busy hostess. Normally, it serves as a lamp or bric-a-brac table. But it is always handy for serving a light snack to a few guests after an evening of cards, as its casters permit it to be rolled to the kitchen where its ample trays are filled and returned to the guest room. Then for large gatherings, it can be pressed into use as a tea cart or serving table. Any hardwood can be used in making the table. The original was turned from basswood and stained a red maple, after which three coats of varnish were applied, allowing a few days between coats. The last coat was rubbed with rottenstone and oil followed by an oil polish.



Paint-Locked Sash Loosened With Block and Hammer



If you can't loosen a newly painted window sash by cutting through the film of paint in the corner between the sash and frame, and it seems that some paint has run between the two, try this method. Set a small hardwood block endwise against the sash frame close to the top and strike it lightly with a hammer. Continue the procedure all the way across the top and down the sides of the sash frame. The hammer blows will break the paint film so that the sash can be opened without breakage.

YOUR IDEAS ARE WORTH MONEY

Popular Mechanics pays readers cash for ideas that are accepted. Have you a shortcut that will save other readers time and money? Then don't fail to send it to the Homecraft Editor. Include a short but complete description and a clear photo or sketch. If usable, we will mail you a check.

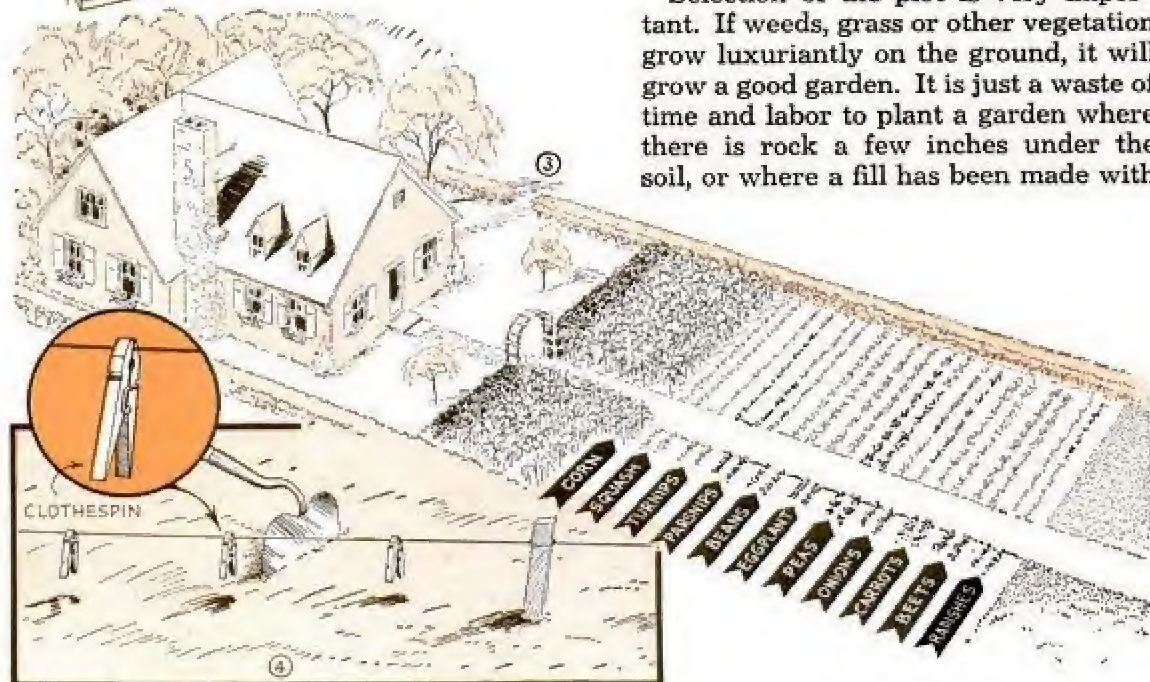
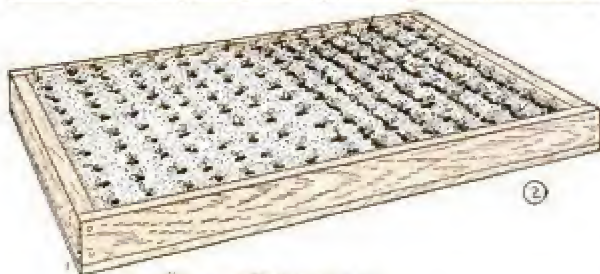
Fresh VEGETABLES



By James R. Ward

BY GROWING your own vegetables, you not only save money, but you have crispy, tasty ones for your table. You don't need a farm to do it either. Even some plants such as strawberries, will grow and produce in a barrel, Fig. 12. Just a few hundred square feet of ground in your yard will do. Figs. 3, 5, 6 and 7 show different ways of converting an average yard into a vegetable garden without detracting from the appearance of the grounds. If a vacant lot is available, you can produce enough vegetables for your table and have plenty left over for canning.

Selection of the plot is very important. If weeds, grass or other vegetation grow luxuriantly on the ground, it will grow a good garden. It is just a waste of time and labor to plant a garden where there is rock a few inches under the soil, or where a fill has been made with



at your BACK DOOR

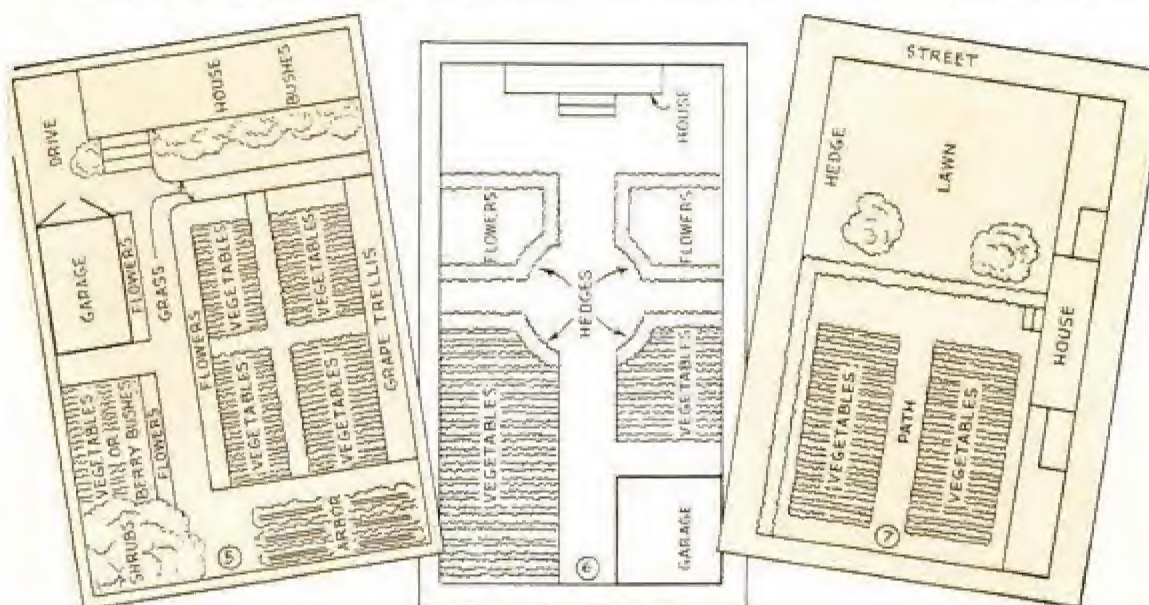


Courtesy Peter Henderson & Co.

cinders, broken brick, stones, etc. The ideal soil is a dark, sandy loam. Do not locate your garden under or near large trees that will steal the moisture and plant food from the crops.

After selecting the plot, you are ready to prepare the soil. Spade or plow it 6 to 10 in. deep. If possible, turn under manure. Leaves and other dead vegetation are also good. Their value as a fertilizer is nominal but they supply humus to help retain

moisture. If the ground is of a clay type, sifted coal ashes worked well into the soil will tend to loosen it. So will wood ashes. Those from soft woods add little food value but most hardwoods contain potash and lime, which are good fertilizers. When natural fertilizers are unavailable, you can use the commercial type at planting time. Before using these, it is a good idea to test the soil so that you can use the food elements needed; a few samples of the soil





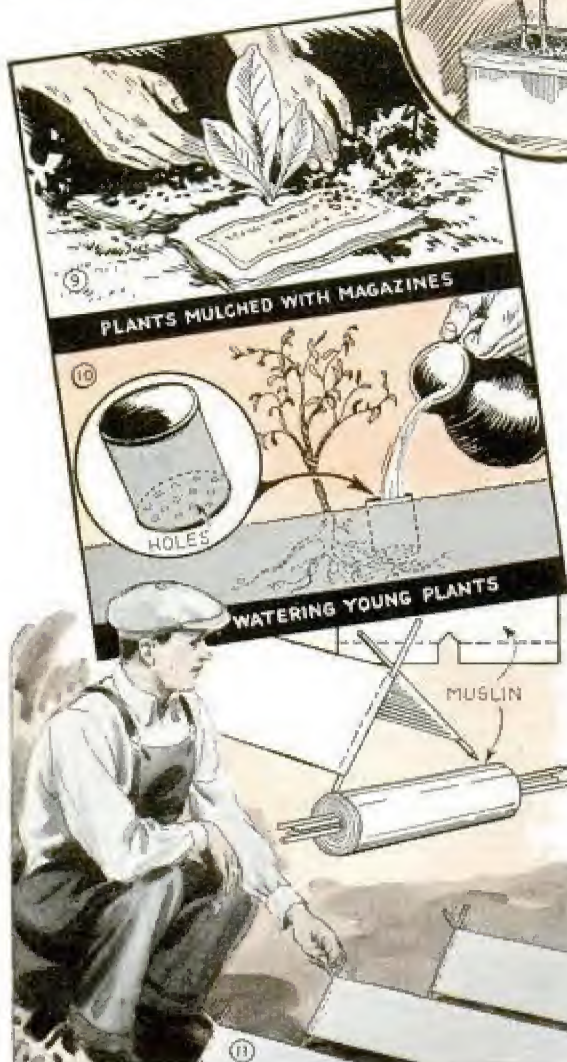
can be sent to your local seed company, or to the state agriculture college or university.

Next comes the selection of the seeds and planting. What vegetables to plant will depend on the space available. On a small plot, it is best to avoid those that take considerable space such as corn, cucumbers, etc. However, some vegetables that mature early can be resown in the same ground to have a succession of them, or they can be followed by others in the same space as indicated in the table of Fig. 15. Half the pleasure of a garden is having something to use just as early in the spring as possible. To do this, seeds are started early and then transplanted in the garden after danger of frost is past. Truck gardeners start theirs in hotbeds, but the home gardener who needs only a few of

each kind can start them indoors in window boxes or flats, Fig. 1. The flats should be kept in a south window and the temperature should be maintained over 60° F. Tomatoes, cabbage, peppers, eggplant and lettuce can be started this way and then transplanted later. The seeds are sown thickly in tiny drills and transplanted to another flat in small hills after they

have grown to a height of an inch or so, Fig. 2. The plants mentioned above can usually be purchased locally, but it is fun to grow them yourself. Other vegetables that do not permit transplanting in the usual way, can be started early if the seeds are sown in individual containers such as ice-cream cartons, flowerpots or berry boxes, Fig. 8. In transplanting, be careful not to disturb the root system. Cut the container away and set the entire contents in the ground. Perhaps the best way for the small gardener is to have six to twelve containers of each vegetable started indoors for early use, and then start the rest of the garden in the usual way by sowing seeds in the ground or by purchasing the seedlings.

Vegetables are divided into about four groups as to planting time. Early cabbage,



see March 1917-330

kale, onion sets, peas, potatoes, spinach and radishes may be planted two weeks before the average date of the last killing frost. Beets, Swiss chard, carrots, lettuce, peas, cauliflower and sweet corn should be planted about the date of the last killing frost; while beans, parsnips, salsify, cucumbers and tomatoes should not be planted for at least a week after frost. Heat-loving plants, such as peppers, eggplant, Lima beans, etc., should not be planted until the ground is thoroughly warm.

As soon as the weather permits, work down the ground, which has already been spaded or plowed, and prepare it for planting. Use a garden rake and pulverize the soil finely. If you are using commercial fertilizer, work it into the ground as you prepare the seed beds. If you want to conserve the fertilizer, work it into the soil only where the seed rows are to be made or where seedlings are to be transplanted. In general follow the directions on your seed packets. Use a guide line to make straight seed furrows. Fig. 4 shows a good marker to get uniformity in rows of vegetables that are planted in hills.

Seedlings that have been transplanted must be protected from the sun for a few days. Fig. 11 shows a good way to do this. When transplanting seedlings wrap paper around the stems as in Fig. 13. This will keep cutworms from killing them. If your garden plot is unfenced, a coil spring to shield each transplanted seedling, as in Fig. 14, will keep dogs or cats from breaking them off. If you have only a few seedlings, a tin can buried beside each one when it is transplanted, Fig. 10, will enable you to water it easily during dry weather. Or, you can mulch each one with an old magazine or newspaper, Fig. 9, to retain the moisture in the ground. Also, mulching of entire small plots can be done by laying heavy paper between the rows and weighting it with a little soil.



15

PLANTING TABLE			
Kind of Vegetable	Planted	Bears Until	Replaced by
Beans, pale and lima . . .	Late May	Frost	
Sweet Corn, late or main crop . . .	Mid-May	Sept.	Pumpkin and vine Squash planted in corn rows by mid June will succeed the corn
Sweet Corn, mid-season varieties . . .	Mid-May	Mid-Aug.	
Sweet Corn, early varieties	Mid-May	Early Aug.	
Tomatoes, set from hotbed	Late May	Frost	
Peas, late or main crop varieties	Apr. or May	Early Aug.	Rutabaga and late Turnips
Peas, early and mid-season varieties	Apr. or May	Mid-July	
Beans, dwarf or bush varieties	Mid-May	July	Cabbage and Cauliflower from seedbed
Lettuce and Endive	Apr. or May	Mid-July	
Cabbage and Cauliflower	Apr. or May	Aug.	Beets for fall and winter use
Kohlrabi, by rows	Apr. or May	Aug.	
Swiss Chard	Apr. or May	Aug.	Beans, dwarf or bush varieties
Carrot and Turnip, early varieties	Apr. or May	Aug.	
Radish, Mustard and Cress	Apr. or May	July	Lettuce and Endive
Onion Sets	Apr. or May	Aug.	
Beets, early varieties	Apr. or May	Aug.	Chinese Cabbage and Florence Fennel, from seedbed or sown in Radish row will occupy the three rows
Spinach	Apr. or May	Mid-June	
Eggplant and Peppers	Late May	Frost	Spinach for fall use
Beans, bush lima	Late May	Frost	

Garden-Marker Line Tightened And Anchored With One Stake



Pointed at the ends and pivoted together with a small bolt, two lengths of broomstick provide a handy stake unit with which a garden-row marker can be tightened and anchored easily. The line is wrapped around one stake, which is then pushed into the ground. Then the other stake serves as a handle to turn the one in the ground and tighten the line, after which the handle is tilted to engage the ground and prevent the assembly from turning to loosen the line.

Centrifugal Paint-Brush Cleaner Used in a Drill Press



Cleaning of a paint brush can be done quickly if you use this simple centrifugal jig, which is rotated in a drill press. It consists merely of a small C-clamp welded or riveted to a short rod of a size to fit in the drill-press chuck. In use, the brush to be cleaned is held in the clamp

as indicated and lowered into a pan of cleaner, after which it is slowly swished

around by pulling on the drill-press belt. Then the brush is raised to clear the cleaner, and the drill press is turned on to rotate it rapidly. This throws out the cleaner and dissolved paint by centrifugal force, after which the operation is repeated. A fairly deep container is necessary so that both operations can be carried on inside it.

Lead Weights Hold Wood Batten For Drawing Accurate Curves

Accurate curves may be drawn by ship-builders' methods in which lead weights and close-grained flexible wood or celluloid battens are used as indicated. To cast the weights, first make a pattern of pine, tapering all sides to facilitate removing it from the mold; give it two coats of shellac and sand smooth. Next make a wood flask about 1 in. larger than the pattern and roughen the sides or drive nails in them to hold the plaster. Now brad a small cleat

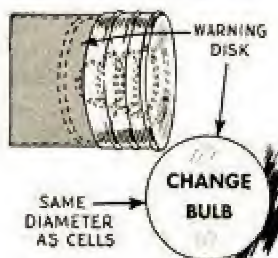


to the bottom of the pattern, oil it and fasten in the center of the flask. Fill the flask slowly with plaster-of-Paris mixed to a rather stiff consistency and when it has hardened, turn a screw eye into the bottom of the pattern and lift it out. For the hold-down point on each weight, bend a 10d nail

slightly at both ends and nail a cleat on the flask temporarily to hold it in place as shown. Cover the mold surface with graphite, melt lead, 2 lbs. or more, remove the slag and pour it into the mold slowly. When cold, remove the weight, file or sand the rough edges and glue felt on the bottom. Finishing touches consist of giving the weights two coats of shellac and filing or grinding the nails to a spur point.

—Charles A. King, East Kingston, N. H.

Burning-Out of Flashlight Bulbs Avoided by Warning Disk

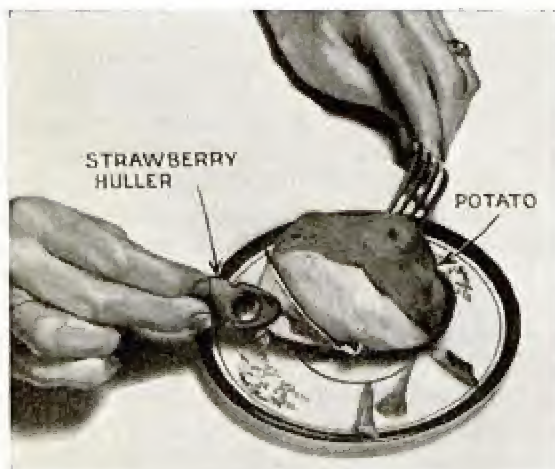


If you carry an extra flashlight bulb of lower voltage than the regular one to use when the battery weakens, a warning disk put in the bottom of the case

will prevent you forgetting to change to the stronger bulb when putting in a new battery. The disk should be metal and is placed on the bottom of the lower dry cell. Any lettering desired to serve as a warning can be printed on the disk.

—W. C. Wilhite, Carlinville, Ill.

Hot Potatoes Are Peeled Easily With Strawberry Huller



When potatoes are boiled in their "jackets," a strawberry huller is just the thing with which to peel them while they are hot without burning the fingers. Steady the potato with a fork and use the huller as indicated.

Small Flag Warns Pedestrians Of Hose Across Sidewalk



Next time you have to run a garden hose across the sidewalk in front of your home when watering the lawn, why not set a small red flag on the walk near it to warn pedestrians and possibly avoid an accident? It takes only a few minutes to make a handy flag for this purpose from a piece of red cloth and a length of heavy wire bent as indicated.

'Ice Bag' Keeps Can of Milk Cool While on Way to Market

One dairyman keeps his milk or cream from souring while hauling it to market by suspending an ice-filled container inside of each can. The bag is a length of inner tube, cemented together at one end and tied with a string at the other, the string being long enough to project up past the cover, which holds the ice container suspended in the can, as shown.



STURDY DINETTE SET

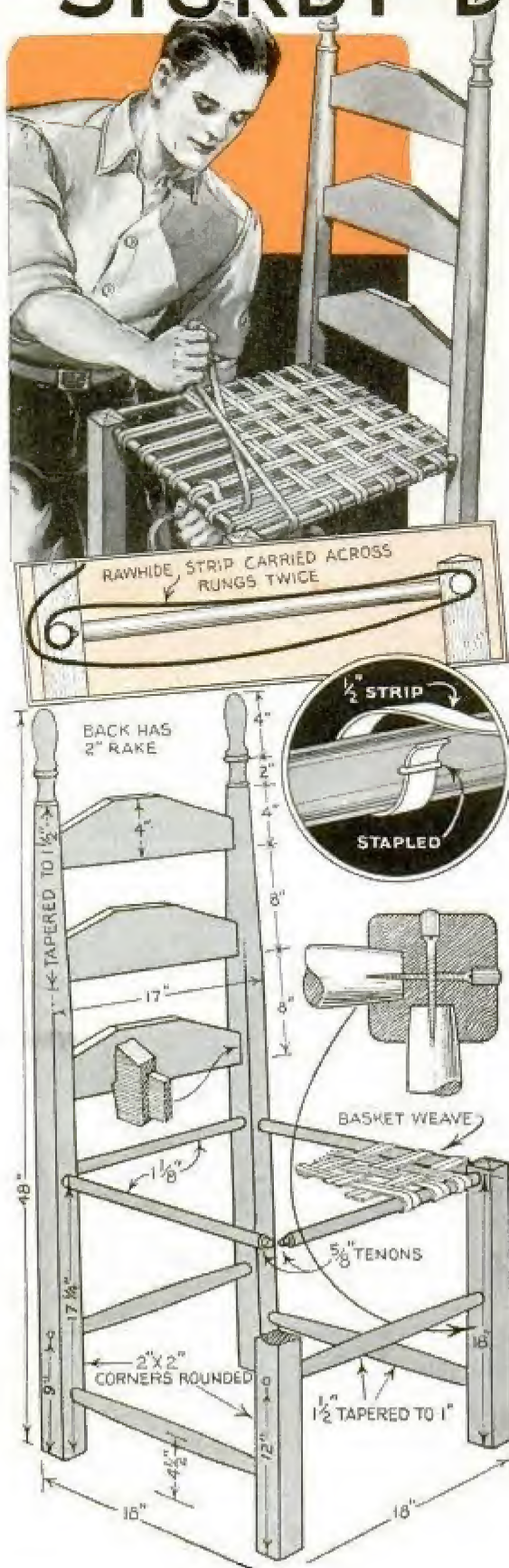
Substantial table has pull-out ends to permit insertion of extra leaves, and the ladder-back type chairs have leather or rawhide seats

HERE is an extension table and set of chairs especially designed for those who have a small dining room and would like furniture of a rather rustic type. Construction of these pieces is relatively simple and the whole set can be made with a few hand tools. Both ends of the table slide out so extra leaves can be added. Almost any kind of wood can be used, even white pine, although hardwood is more durable and provides greater rigidity.

The table legs are cut from square stock and tapered slightly toward the top. While lag screws are used for securing them to the leg crossrails, both end stretchers are mortised, glued, and dowel-pinned. Before fastening the top permanently, the upper edges of all boards are chamfered to form V-grooves when assembled. Both extension ends are mounted on slides that permit the ends to be pulled out so that room is provided for two 10-in. leaves. Dowel stops near the end of each slide prevent the extension ends from being pulled clear out.

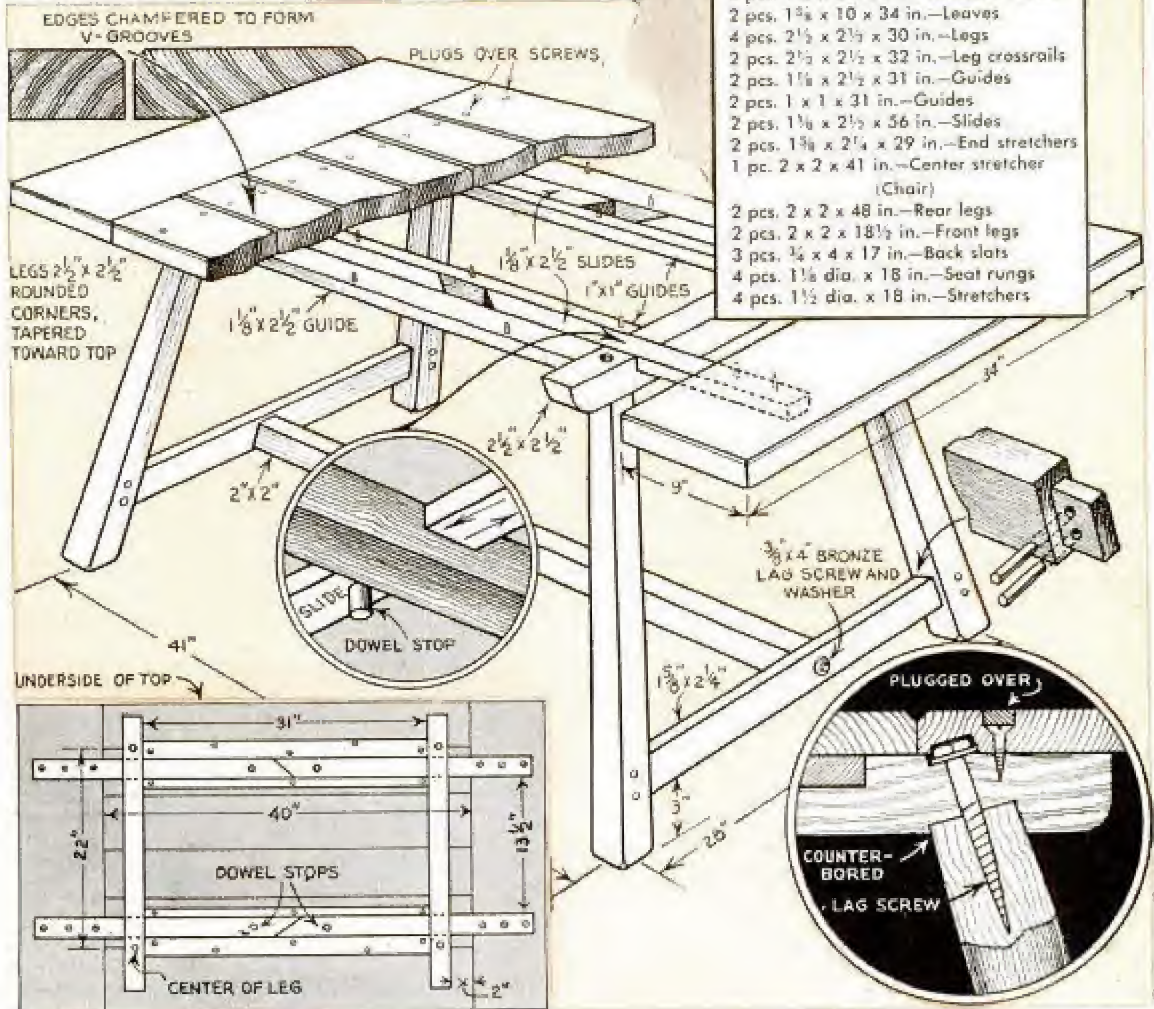
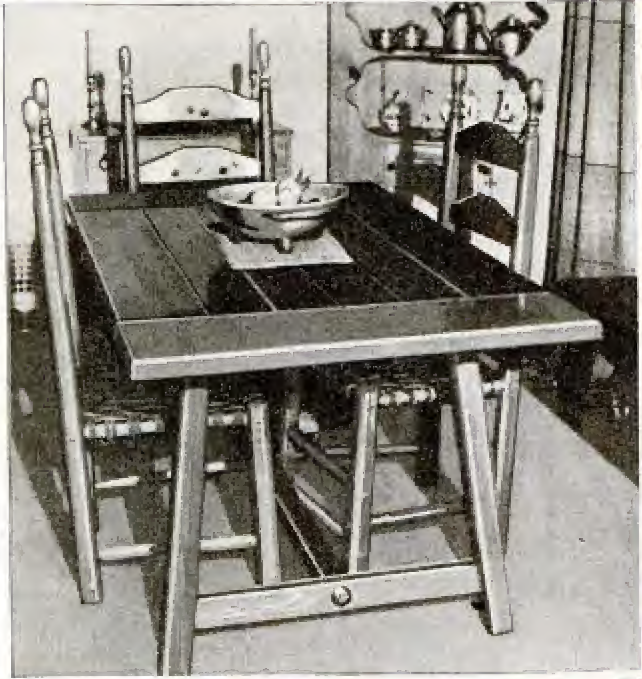
Like the table legs, all chair legs are cut from square stock after which the corners are rounded. If a lathe is available, tops of the chair-back uprights can be turned as indicated, or they may be tapered slightly and finished off square. Also, the rungs may be shaped from square stock, using hand tools to round the corners and taper the ends, which are forced into holes bored in the legs. Strips of $\frac{1}{2}$ -in. rawhide that make up the seats in basketweave pattern, are stapled on the inside of the seat rails, each strip being carried across the top of the rails twice.

Finishing the set is a matter of preference, but if an open-grained wood has been used, such as mahogany, walnut or oak, the pores must be filled with a prepared paste filler of the proper color. After the filler has been wiped off and has hardened, the work is sanded lightly and dusted, after which shellac and wax or several coats of high-grade varnish are applied, if a natural finish is desired.



100 W.P.

built with hand tools...



MATERIAL LIST (Table)

- 2 pcs. $1\frac{1}{2} \times 7 \times 40$ in.—Top center
- 4 pcs. $1\frac{1}{2} \times 5 \times 40$ in.—Top center
- 2 pcs. $1\frac{1}{2} \times 9 \times 34$ in.—Extension ends
- 2 pcs. $1\frac{1}{2} \times 10 \times 34$ in.—Leaves
- 4 pcs. $2\frac{1}{2} \times 2\frac{1}{2} \times 30$ in.—Legs
- 2 pcs. $2\frac{1}{2} \times 2\frac{1}{2} \times 32$ in.—Leg crossrails
- 2 pcs. $1\frac{1}{2} \times 2\frac{1}{2} \times 31$ in.—Guides
- 2 pcs. $1 \times 1 \times 31$ in.—Guides
- 2 pcs. $1\frac{1}{2} \times 2\frac{1}{2} \times 36$ in.—Slides
- 2 pcs. $1\frac{1}{2} \times 2\frac{1}{4} \times 29$ in.—End stretchers
- 1 pc. $2 \times 2 \times 41$ in.—Center stretcher

(Chair)

- 2 pcs. $2 \times 2 \times 48$ in.—Rear legs
- 2 pcs. $2 \times 2 \times 18\frac{1}{2}$ in.—Front legs
- 3 pcs. $\frac{3}{4} \times 4 \times 17$ in.—Back slats
- 4 pcs. $1\frac{1}{2}$ dia. $\times 18$ in.—Seat rungs
- 4 pcs. $1\frac{1}{2}$ dia. $\times 18$ in.—Stretchers

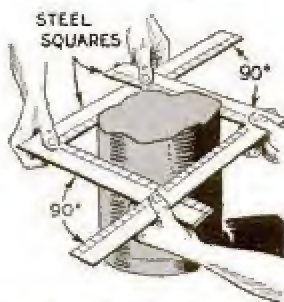
Shield Keeps Child's Fingers Out Of Sewing-Machine Handwheel



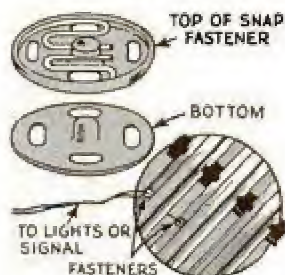
To prevent small children from getting their fingers in the handwheel of a sewing machine while it is running, bend a shield from a piece of sheet metal as shown so that it can be slipped on or off the machine easily. A strip of felt glued on the underside will prevent scratches on the cabinet.

Diameter of Cylindrical Work Measured With Steel Squares

The diameter of large cylindrical work can be found by using two steel squares as indicated. When the tongue of one square is at right angles to the blade of the other, the reading on the inner scale of either square will give the diameter of the cylinder.



Electrical Snap Connectors For Model Railroad



I find that dress snap fasteners make ideal electrical connectors for use on model-railroad systems. With them, electrical connections are made or bro-

ken easily and quickly. One part of the fastener is soldered to the rails or other place where connections are to be made, and the other part is soldered to the lead wire of lights, signals or other accessories. For good electrical contact, use plain metal fasteners, not enameled ones.

—Richard Sklenar, Tekamah, Nebr.

Saw Blades in Transparent Case Selected at a Glance

Selecting a saw blade from this case is just a matter of turning the hole in one end to the group of blades desired and pulling out one. The case consists of a piece of round soft wood, such as a window-shade roller, which is grooved around the sides to provide receptacles for the blades, and a celluloid cylinder. The latter is made by cutting a piece of clear celluloid to size and cementing the edges together with acetone. Tin disks over the ends close the blade receptacles, one being drilled and pivoted so that it can be turned to remove the blades.



Yarn Wound on Cake Rack to Dry After Steaming It

After steaming yarn to remove the kinks, when it has been unraveled from a knitted garment, wind it on a wire cake rack. It is much easier to handle in this way, and the rack can be hung up with a clothespin, permitting the yarn to dry thoroughly.



BEFORE YOU BUY A HOUSE



"Lay of the land" is the first thing to look at outside the house. Next, the walls should be carefully inspected for defects from cornice to grade. Finally, details such as gutters, roof flashing and the condition of the shingles

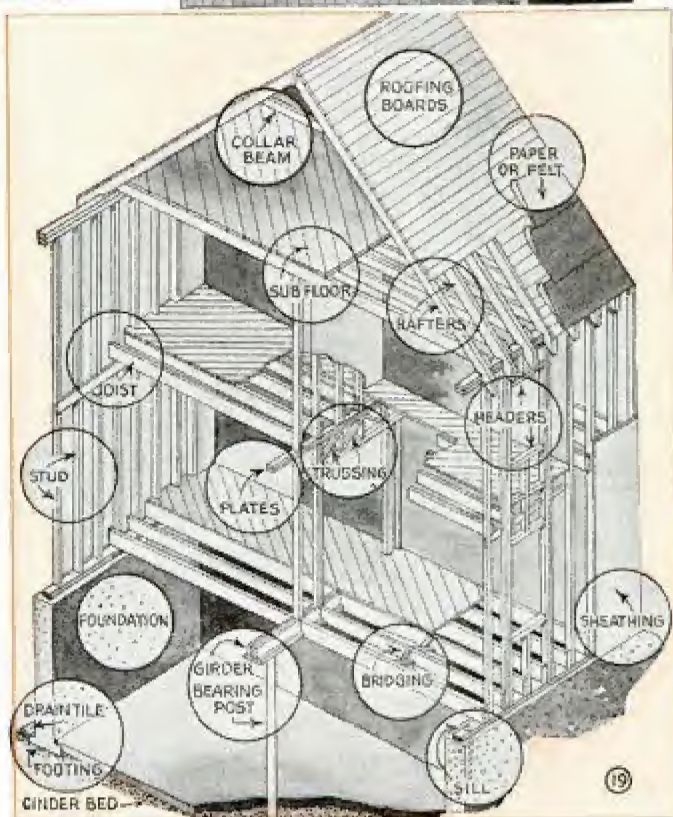
By W. Clyde Lammey

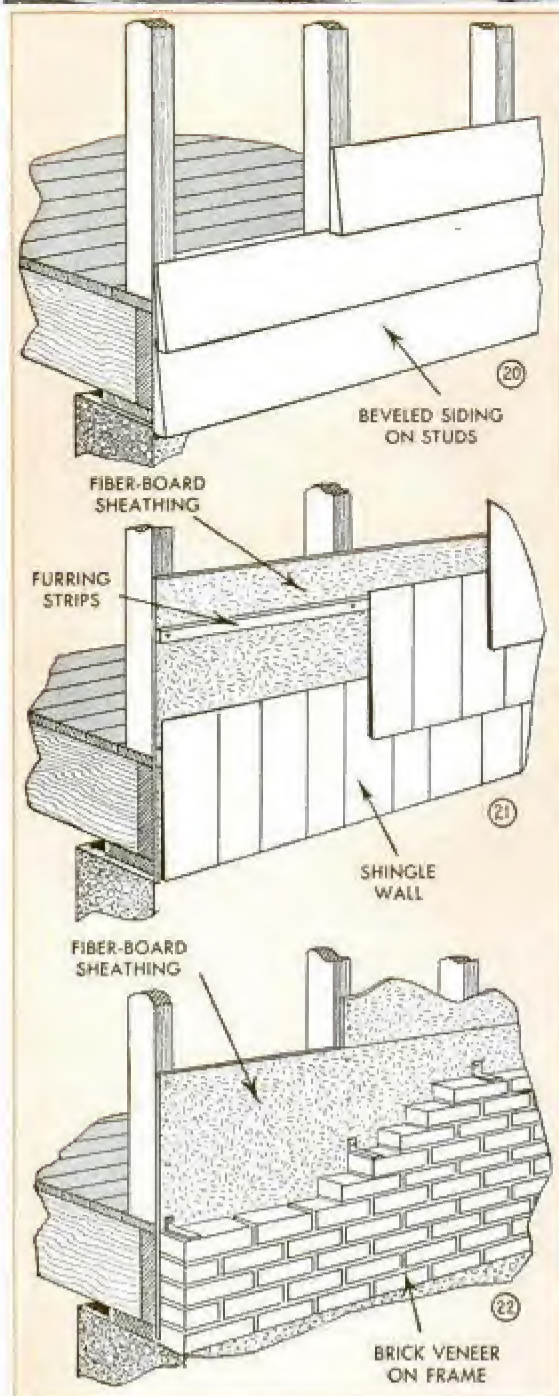
Part II

AFTER you have examined the interior of a house, noticing carefully the condition of ceilings, walls, floors, plumbing and heating equipment, and basement walls, you should make a detailed inspection of the outside in much the same way. Jot down your findings in your note book. This data is especially helpful if you are looking at a number of houses, which means you will have to decide on a basis of carefully weighed advantages and disadvantages.

The first thing to notice outside is, literally, the "lay of the land." It's very important, too, for it may mean the difference between a well-drained location and a "sump" or low spot. The latter may be the cause of such recurring troubles as sluggish drainage after prolonged rainfall, sinking sidewalks, flooded storm sewers, steady seepage through basement walls, undue settling of the foundation, etc. Such things have a very definite bearing on resale value of the property, also. This point always should be kept in mind, for the cost of remedy added to the initial cost may mean a total investment considerably above the market value of the property.

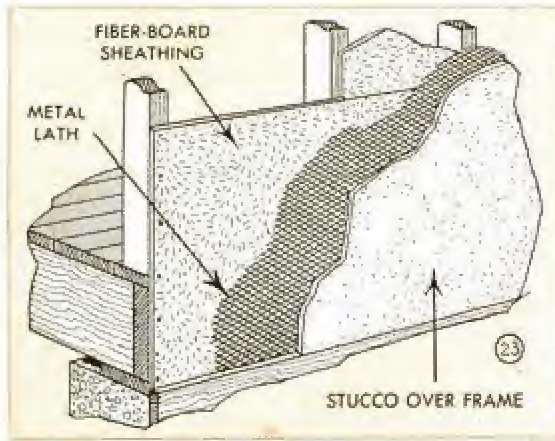
So, look up and down the street, across the street and back in the alley—if there is an alley. Note carefully the slopes to or from the location. If the house is near or on the crest of a hill or even a





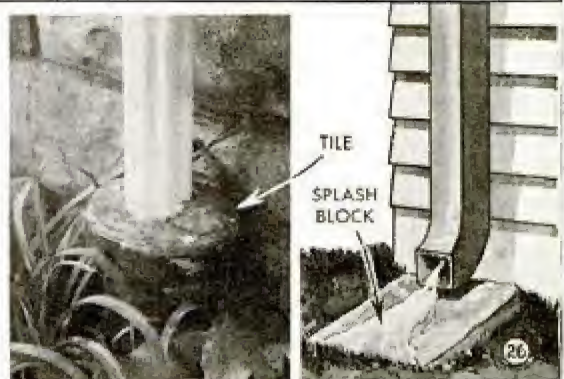
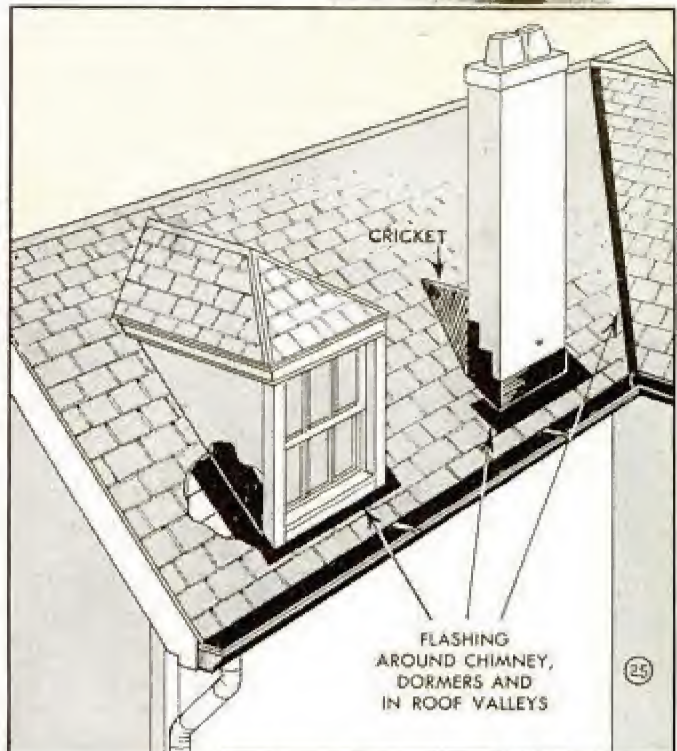
slight rise one can generally assume, other things being usual, that the basement will be dry and that drainage will be adequate. Even if the property is on a steep slope or side hill, drainage is likely to be good unless the land above the house is flat and the latter area is of considerable extent. Then it sometimes happens that there is a springlike seepage either above or on the property. In connection with the lay of the land, always find out about storm sewers and particularly the location of the branch connecting with the basement drain. Once you know the location of the connecting branch, note if there are any large trees near it. Sometimes tree roots give trouble in tile drains, by pushing fine feeding roots into the drain through joints, or by larger roots growing under the tile and heaving and breaking it. If the property is located in a low, flat area which appears to be of considerable extent then the thing to find out is whether or not there is natural drainage to carry away subsurface water. The point to remember is that wherever there is an unduly slow drainage of subsurface water from one point to another or to lower levels, the chances of continuing water and frost damage to basement walls, footings, floors, and walks are increased.

Next comes the exterior of the structure itself. Usually it is rather difficult to tell about the framing. The details in Fig. 19 show what is generally accepted as good. However, unless you can question the builder, you will have to judge the soundness of the framing by the visible exterior and interior details of the building. If the house has stood for some years and still has that general well-set-up appearance, with tight siding, uncracked masonry or brick (depending on the construction), plumb corners and walls, and a true ridge line, then there's little need to bother about the framing. One thing always to watch for in



an older house is whether or not the beveled siding is nailed directly to the studding, no sheathing at all, Fig. 20. You can generally tell by rapping smartly on the siding. If a rap produces a thin, hollow sound investigate further. If heavy tongue-and-groove drop siding was used then the defect is more easily remedied. But where beveled siding is nailed directly to the studding there is no satisfactory way of furring the walls for stucco or shingles. It can be done, of course, but is not always permanent. Figs. 21, 22 and 23 show generally approved wall construction for shingles, brick veneer and stucco, using a fiber-board insulating sheathing. However, it is only in houses built in the last few years that one will find this particular wall construction. Prior to this a shiplap sheathing was generally used. All types are good provided the work was properly done by reputable builders. In new homes without basements the walls should be examined carefully for defects. If they are available, the builder's specifications should be checked. A careful builder will have followed them in every detail.

It is always a good idea to check the four corners of a house with the spirit level, as in Fig. 24. Be sure to note whether there are any evidences of faulty flashing around the chimney, dormers and in roof valleys, Fig. 25. It may be necessary to go into the attic and make a detailed inspection for evidences of leaks. Usually the remedy is

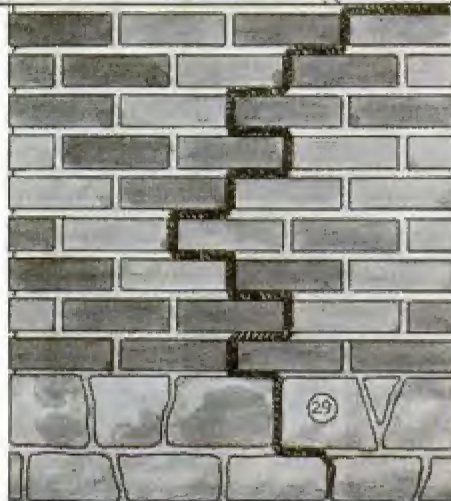
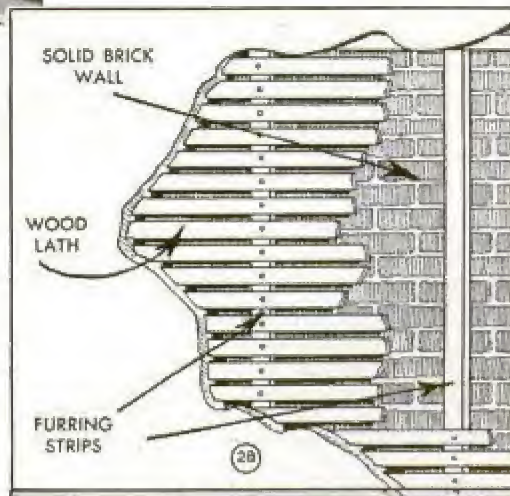




simple and inexpensive but on certain roof designs it may be rather difficult. The upper side of a wide multiple-flue chimney projecting through the roof at any point below the ridge should be protected by what is known as a "cricket." This is a triangular-shaped affair of sheet metal which is flashed to the roof and chimney and prevents any accumulation of water and snow on the upper side. Another thing to look at closely is the provision for the disposal of water from the gutters. This is important because the drainage problem is involved and it will take time and money to remedy any defect. Fig. 20 shows two common methods, either of which is effective. Leading the downspouts into a tile that connects either with a cistern or the storm sewer is in some respects the best, although a splash block is suitable if it is large enough to conduct the water some distance from the basement wall. In connection with the cistern, remember to ask about the construction. It is generally conceded that in a reasonably well-drained location the best construction for a cistern requires that it have a concrete bottom or "floor," but the sides should be of brick laid up loose, that is, no mortar in the joints. Some older cisterns have a fine gravel or sand bottom. In any case the cistern should be provided with an overflow and manhole for cleaning.

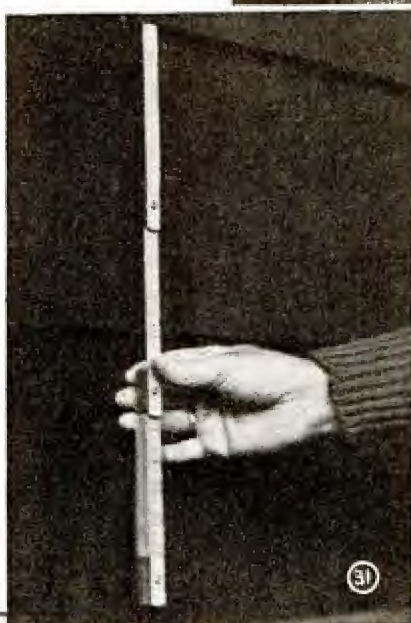
The drawing above Fig. 20 brings up another point to consider. Here all the homes are of fairly

new construction and of a more nearly uniform size but quite frequently you will see a large house, old in years, and flanked on either side with smaller, newer homes. Of course, such a dwelling looks out of place. Adjacent homes emphasize its date of construction and its probably rather gaunt architecture, while it in turn detracts from the newer developed properties. However, many types of older houses, particularly the L-shaped structures, lend themselves well to inexpensive modernizing. Fig. 27 is an example that offers just one suggestion of what a bit of planning will do to the stiff outlines and drab appearance of an old structure. Picture windows, flush cornices, removal of porches, wide siding to "lower" height, and an addition to break up the ridge lines are a few in-



expensive alterations that change a rigidity of line to a harmony of easy and pleasing contrasts. This done, an old house will no longer look and be out of place. When you're inspecting the exterior of an older dwelling keep in mind what these simple changes can do in the way of adding to livability and resale value.

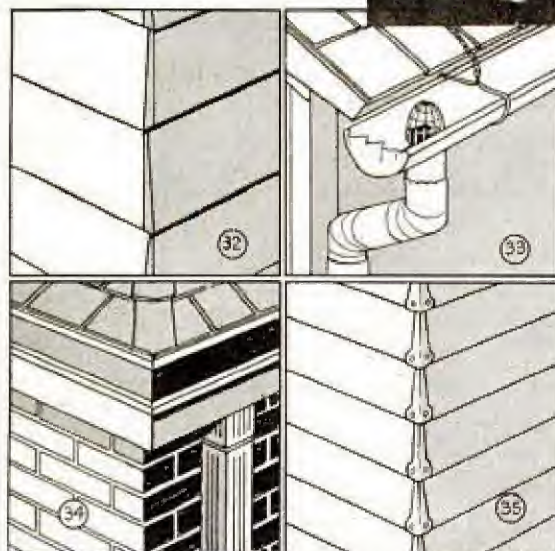
Figs. 28, 29 and 30 bring up still other points in connection with the examination of both the very old and the "middle-aged" homes. If you learn that the walls of any house are solid brick or masonry construction be sure to find out definitely whether the plaster is "furred" away from the wall as in Fig. 28. You will sometimes find plaster applied directly to a brick or masonry wall. Under certain conditions of dampness and temperature changes these walls will "sweat," that is, moisture will condense on the surface and cause trouble, in addition to creating unhealthy living quarters. If you discover a crack in a masonry wall like that in Fig. 29, it generally means that a condition of strain has been developed by undue and unequal settling. Unless the crack runs the height of the wall, involves a corner or the adjacent sections show evidence of movement, it is generally safe to assume that the crack can be pointed up and will give no further trouble.



Another defect to look for, especially in brick veneered walls, is an open-horizontal crack. If it runs for only a short distance the chances are it is not important, but if it is long and well open it may mean that the wall is tipping or bulging outward. Such instances are comparatively rare and are likely to be due to causes other than poor

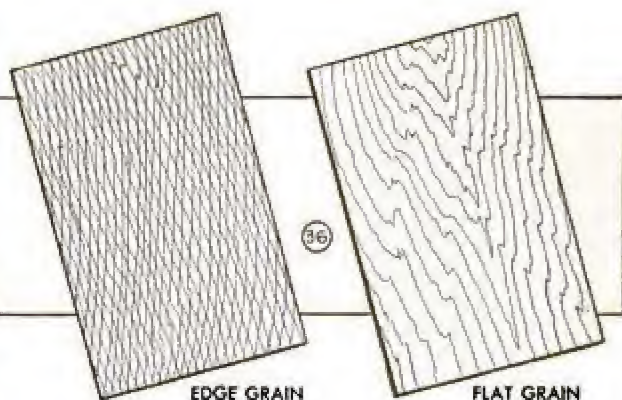
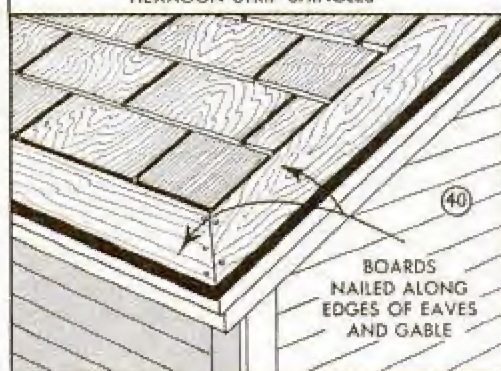
workmanship. "Blisters" on stucco walls, due generally to moisture getting behind the stucco coating, are more or less minor defects as it is usually easy to remedy the conditions causing the trouble. Chip the mortar in brick or masonry joints with a penknife or other sharp-pointed tool, Fig. 30. If it's hard it's probably in good condition throughout the whole structure, but if it's soft and powdery better look the walls over carefully for other evidences of crumbling mortar.

On shingled walls there is little likelihood of defect except where the staining has been neglected and where the shingles have been laid with a greater exposure to





HEXAGON STRIP SHINGLES



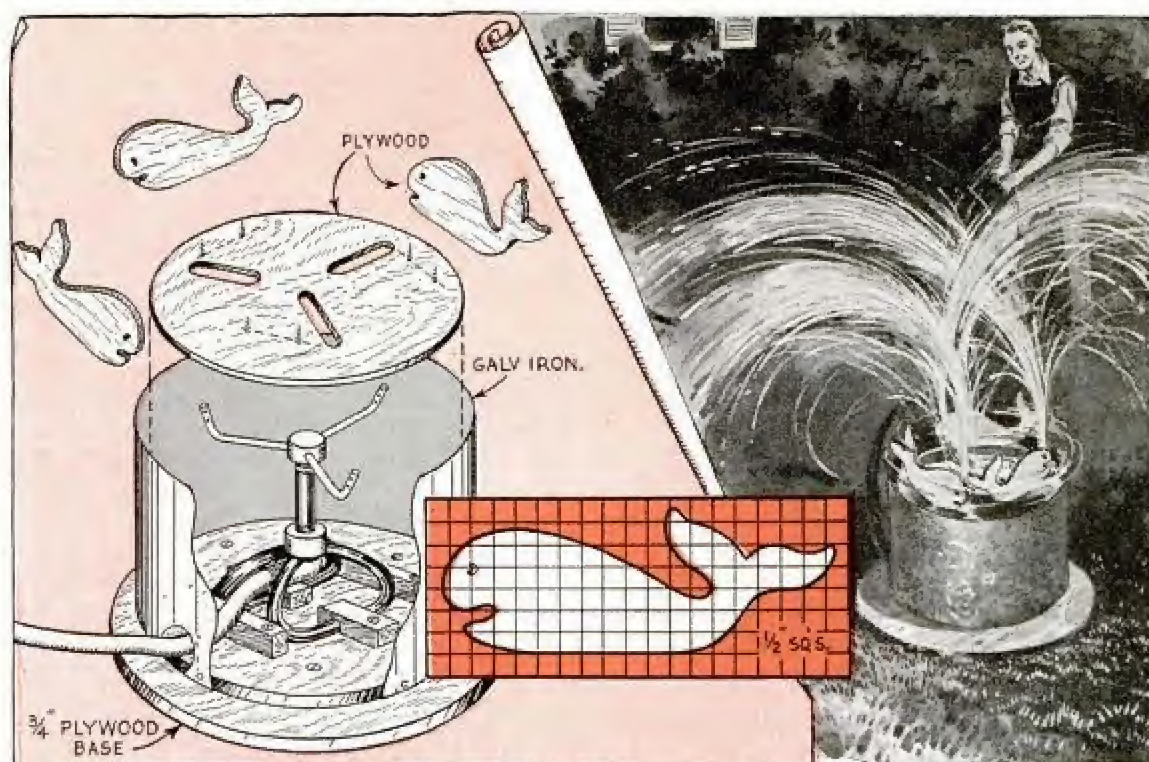
the weather than recommended, Fig. 31. When shingle walls are double-coursed and butt-nailed the exposure is often as much as 12 in. for a 16-in. shingle, and 16 in. for a 24-in. shingle. Note whether the shingles at the corner are "laced," that is, overlapping, or whether they are mitered, the latter being generally considered the best construction. Note also whether shingles are of the flat or edge grain type, Fig. 36, the latter being considered the best. Beveled siding is sometimes cornered as in Fig. 32, but a better job is mitering and finishing with a metal corner strip, Fig. 35.

Although gutters are a comparatively minor item they should, of course, be included in the inspection. Usually they are either of the hanging or box type, Figs. 33 and 34, the latter being perhaps the best because it can be anchored solidly to the cornice. However, it is more difficult to remove when renewal is necessary. The type of cornice tends to "date" a house. The overhanging, open type, Fig. 37, is desirable from the standpoint of weather protection, but it is difficult to paint, necessarily weaker and tends to darken the interior of the house. The narrow box cornice is generally more to be desired because it is better in structural detail and appearance.

Next comes the roof. Wooden shingles should be laid with the edges abutting, not separated as in Fig. 38. Also, abutting edges should be located as much as possible over the center of shingles in the next row underneath. There are several types of composition strip shingles, the hexagon type, Fig. 39, being a common one.

If the house has been re-roofed, composition shingles over wood shingles, or wood over wood, find out whether edging boards, Fig. 40, have been fitted at the gables and in the valleys along the eaves. Frequently this essential detail is omitted in re-roofing. Composition shingles laid without edging boards are apt to be stripped off at the gables and eaves by a high wind, necessitating a troublesome repair.

Revolving Sprinkler Cutouts Give Novel Effect



Miniature cutouts of whales that give the appearance of swimming and "blowing" in a lifelike manner make this sprinkler a novel addition to other lawn and garden ornaments. Almost any $\frac{1}{4}$ -in. wood or hard-pressed board can be used for the cutouts and top, and the base disks can be cut from $\frac{3}{4}$ -in. stock. After assembling the two-part base, the sprinkler head is cen-

tered on it and fastened securely with four cleats. A piece of galvanized iron or a large tin can, with the top and bottom removed, provides a shield to hide the head and a screw eye driven into the edge of the base makes a convenient method of hanging the unit on a wall when not in use. Also, the can or metal shield serves as a handy reel on which to wind the hose.

Cover for Overflow Speeds Opening of Clogged Lavatory

When opening a clogged lavatory or bath-tub drain with a plumber's force cup, the job can be done quickly if an airtight cover is clamped on the overflow. This makes it possible for all of the air pressure to be forced down the drain pipe instead of allowing some of it to escape. The cover consists of several pieces of rubber, cut from an old inner tube, two pieces of tin and a couple of stove bolts with washers and wing nuts to fit. Bolt heads are cut off and the ends bent to form L-hooks after which the overflow opening is measured and holes made in the rubber and tin pieces to take the bolts.

—E. G. Machauer, Memphis, Tenn.

☐ When lemons become dry they can be softened by immersing them in cold water.

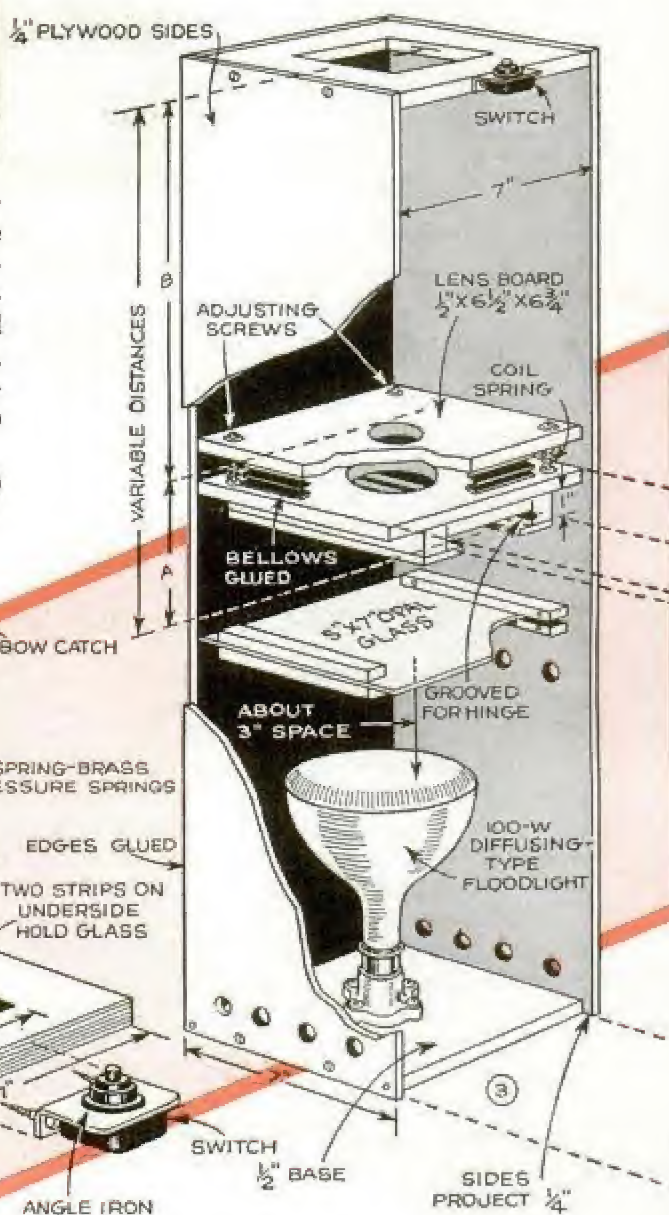
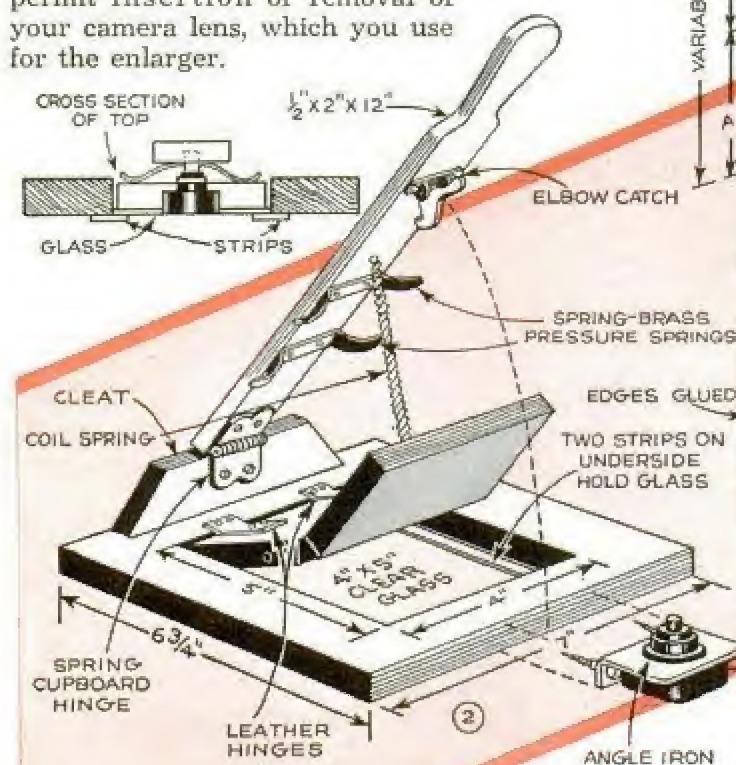
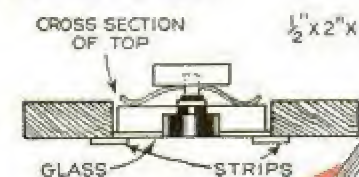




Simple ENLARGER

For illumination you use a 100-watt floodlamp of the diffusing-type in which a silvered reflector is integral. About 3 in. above the top of the lamp a 5 by 7-in. opal glass is mounted so that it slides between two cleats. The center-support piece is located about 2 in. above this, and it has a hole in the center a little larger than the hole in the film carrier, which slides between two guides screwed and glued to the underside of the center-support piece. Above it is the lens board, which is adjustable for focus, and is connected to the

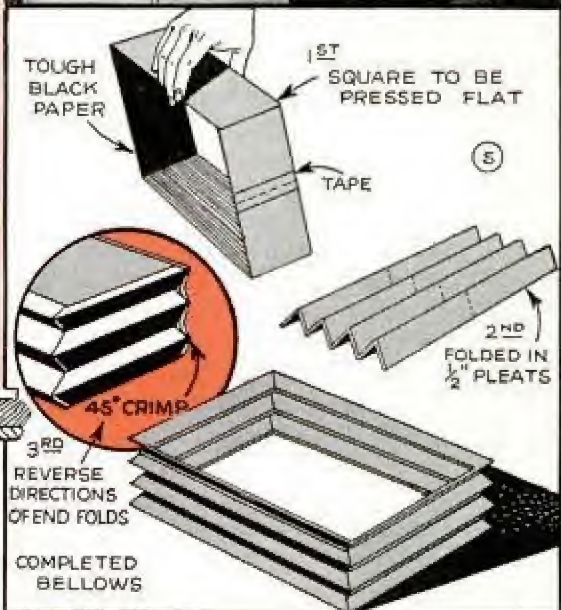
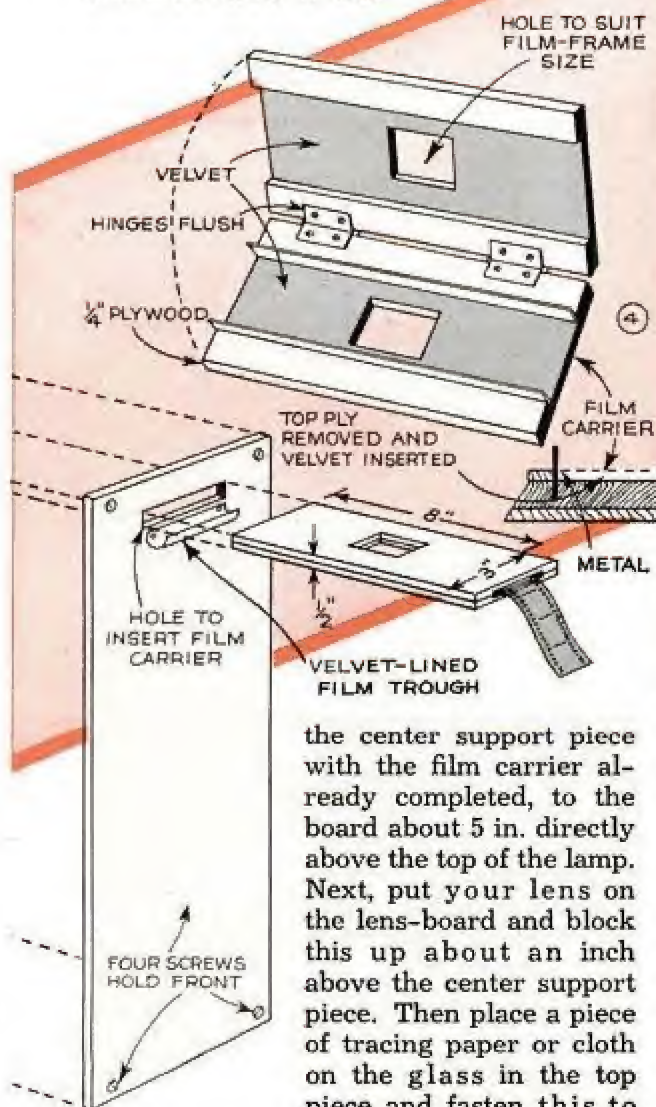
JUST like printing in an ordinary contact printer, it's an easy matter to make one-size enlargements with this small enlarger. Essentially it consists of a box having $\frac{1}{4}$ -in. plywood sides screwed to end pieces and a center-support piece of $\frac{1}{2}$ -in. stock. The lower half of the front is removable while the top half is left open to permit insertion or removal of your camera lens, which you use for the enlarger.



for 35-mm. FILM

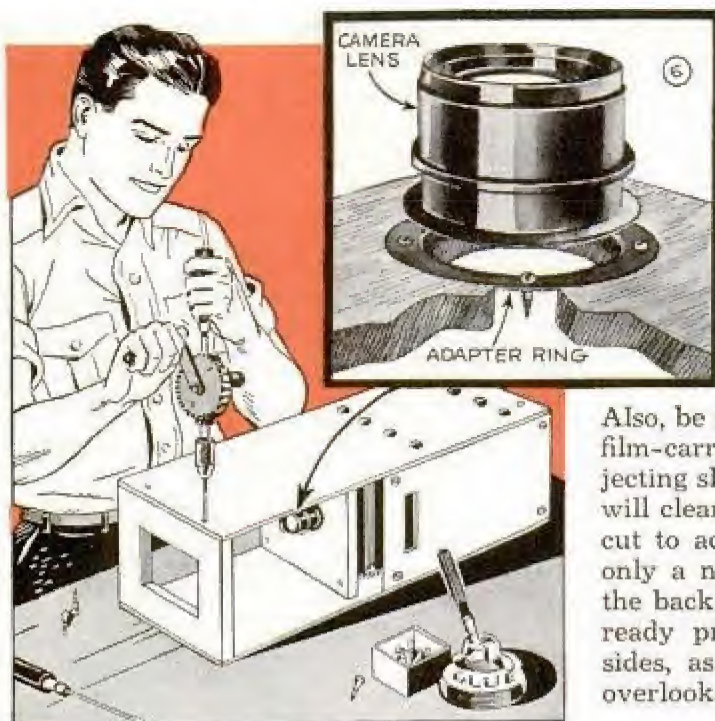
center support piece by means of a simple bellows that allows movement, yet excludes light from the upper portion of the enlarger. The bellows can be made from imitation leather and is cut as shown in Fig. 5.

As the enlarger is made to suit your particular camera's lens, and is designed for enlarging to a predetermined size, there are two variable dimensions, A and B, Fig. 3, that must be ascertained. These dimensions should be determined as accurately as possible. To do this you fasten the lamp to the base, already cut to size. Fasten a board to extend vertically from one edge and then screw or nail



the center support piece with the film carrier already completed, to the board about 5 in. directly above the top of the lamp. Next, put your lens on the lens-board and block this up about an inch above the center support piece. Then place a piece of tracing paper or cloth on the glass in the top piece and fasten this to

the board about 10 or 12 in. above the center support piece, Fig. 1. Now, by adjusting the lens-board, you can get the picture (negative being in film carrier) in focus. If picture is too large lower the top and again adjust lens-board to sharp focus until the size of the picture on the tracing cloth is brought to the dimensions you desire. After size and focus have been achieved, carefully measure distances A and B, which will determine the height of the enlarger and the proper spacing between the top, the lens-board and the film



carrier. When the three sides are screwed to the top and bottom, and the cleats to hold the opal glass are in place, again check for exact position of the lens-board before permanently screwing the center support piece in place. The manner in which you attach your lens to the lens-board depends upon the type of lens at hand. Fig. 6 shows how a standard adapter ring can be used to hold a barrel-type lens. Critical adjustment in focusing as well as getting the lens at right angles to the negative is done by four screws that can be tapped into the center support piece which should be hardwood. Coil springs of suitable pressure are slipped over the screws and fit between the lens-board and center support piece. If you desire, each corner of the center support piece can be slotted deep enough to take nuts to line up with the holes, in which the screws are driven—in this case machine screws.

Details in building the top and the film carrier are shown in Figs. 2 and 4. A spring hinge on the handle will keep it in the raised position when placing paper on the glass, and in this position the pressure blocks will also be held out of the way. When the handle is brought down, the pressure blocks contact the paper to keep it in position before the switch is pushed in. An elbow catch is fitted to the underside of the handle to engage the angle bracket on which the switch is mounted.

When making the film carrier be sure that the two hinges are flush with the inside surface of the plywood of which it is made. To make a scratchless film track, remove a strip of the outer ply on each piece as shown, as wide as the film, and then glue in strips of velvet. To retain the film on this cloth track, fit a metal strip along each side of the recess, (see Fig. 4), in the lower piece.

Also, be sure to cut a groove in one of the film-carrier guides so that the hinges projecting slightly from the side of the carrier will clear. The removable front has a slot cut to accommodate the film carrier, but only a narrow velvet-lined slot is cut in the back to permit passage of the film already printed. Ventilation holes in the sides, as shown in Fig. 3 should not be overlooked.

Picture Hooks Hold Background

How to hang a large drape against a wall to serve as a photographic background is a problem that can be solved with ordinary



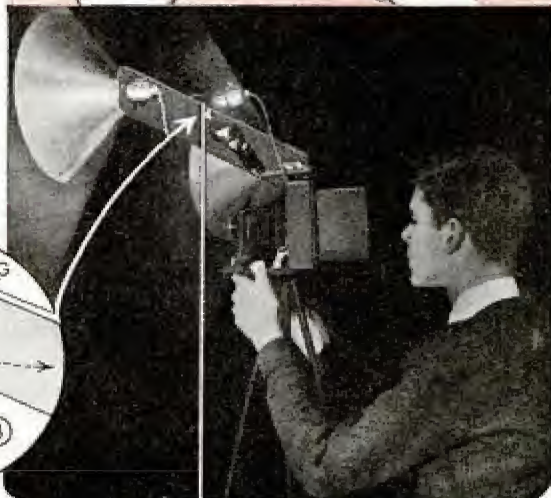
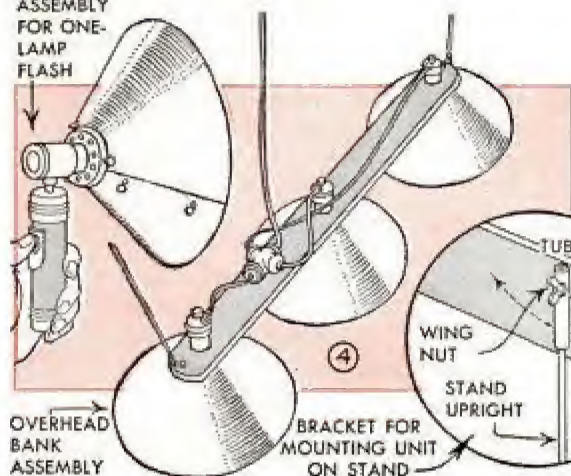
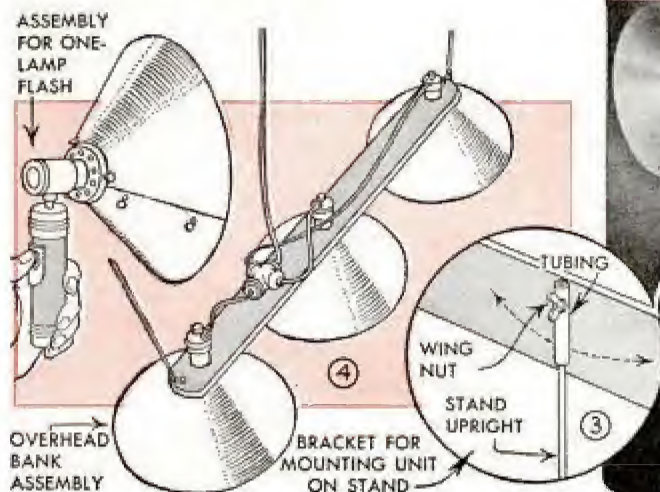
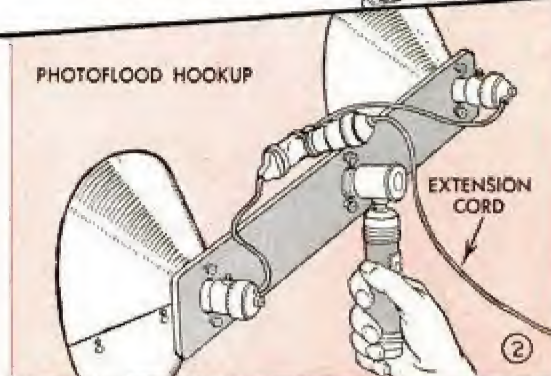
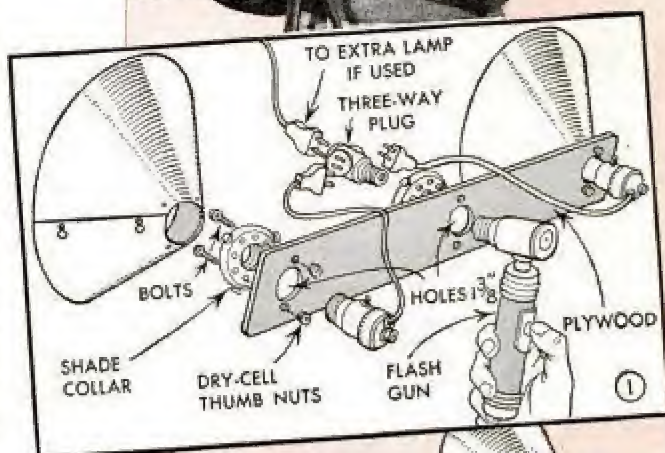
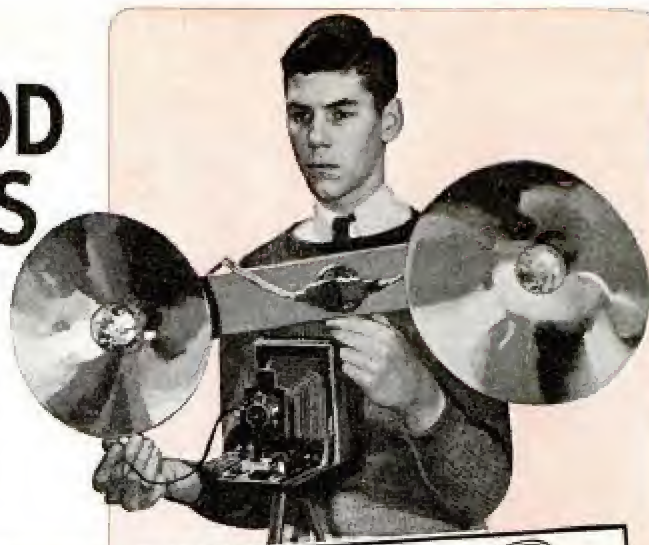
molding-type picture hooks. Attach three or four hooks to the end of the drape and use them to suspend it from the molding. The drape will lie flat and can be removed easily when no longer needed.

—Louis Hochman, Brooklyn, N. Y.

¶“Oyster-ring” effects on ferrotyped prints can be avoided if you first squeegee them under a blotter to remove excess water before they are rolled onto the tins.

Versatile FLASH-FLOOD LAMP UNITS

BUILT from common electrical parts at a nominal cost, the lamps of this lighting outfit can be used separately or in various combinations. Also, the unit can be packed into a flat carrying case no thicker than the diameter of a photoflood bulb. Parts needed to make it are sockets, shade holders, a 3-way plug, an extension cord, a flash gun and reflectors that can be flattened when unhooked at the seam. To use the outfit as a 2-lamp flash unit, screw the plug into the flash gun and insert the lamp leads as in Fig. 1. If desired, an extra lamp for overhead lighting can be connected into the third outlet of the plug. When using photoflood lamps, unscrew the 3-way plug from the flash gun and connect it to an extension cord, Fig. 2. A simple bracket, consisting of a short length of tubing fitted with a bolt and wing nut, permits the unit to be supported on a folding lamp or music stand, Fig. 3. To use the flash gun with a single reflector merely unscrew the parts required from the unit. Fig. 4 shows how the outfit can be used for an overhead bank of lights by suspending it from a support with cords or wire tied through holes in the ends.



Enlarging Meter Read Easily Through Flashlight Lens



Enlarging meters of the grease-spot type can be made easier to read if a bull's-eye flashlight lens is laid over the indicating window. This increases visibility from any

angle. The lens can be lifted between the fingers and used as a magnifier on certain jobs such as enlarging dense negatives.

Skimmer for Photo Solutions

This skimmer removes dust, fibers, etc., that collect on top of a photo solution left standing in a tray. To make it, bend a wire coat hanger into a rectangle and wrap cheesecloth around it.



This Sturdy Lawn Chair Is Designed for Comfort



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Lawn Chair—1058: This chair can be built with a few hand tools. Plan calls for stock sizes of lumber. Curved, slatted seat assures comfort. Complete construction details and list of material will be sent postpaid for only 25c.

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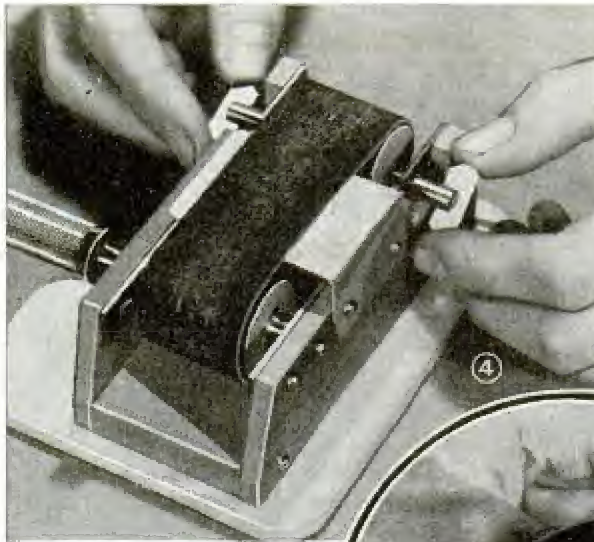
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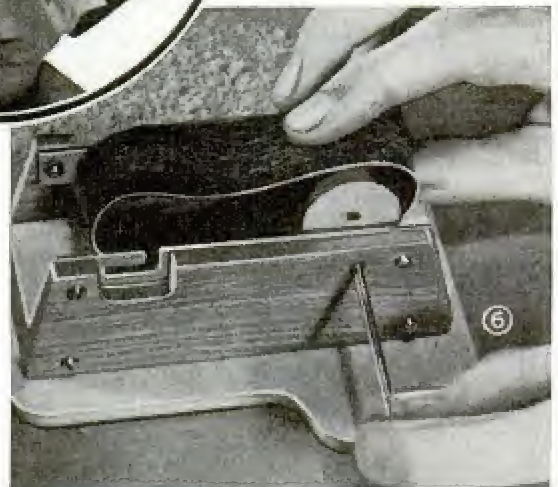
is best to turn the wood drums slightly oversize so that they can be trued later and properly crowned when mounted on their shafts. Short rubber bands cemented edge to edge across the crown of the drums can be used as nonslip tires for the belt. When soldering the drive-drum bearings, keep them at exact right angles in the brass side strips, otherwise the shaft is apt to bind. To drill corresponding bearing and screw-mounting holes in alignment in the wood and metal side pieces, clamp both together and cut at one time. As shown in Fig. 6, the drive drum is removed to make belt changes by loosening the setscrew in the collar which holds it to the shaft,



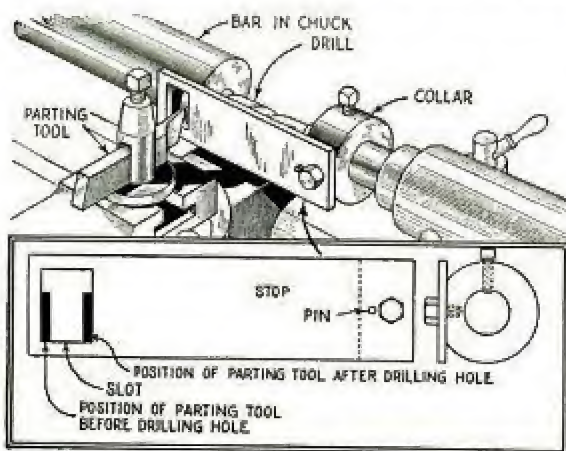
and withdrawing the latter. L-shaped slots in the side strips permit lifting out the idler drum. Fig. 3 shows how the latter is bushed, and then centered on the shaft with a nut at each end, after which one of the nuts is backed off just enough to allow the drum to spin freely. Finally the little belt table is attached with two machine screws turned into tapped holes. The sanding belt will travel smoothly over the drums if the ends are butted at an angle. A cloth tab

coated with flexible cement is used to join the strip, as in Fig. 5.

Trackage of the belt is checked by turning the drums by hand first. If the belt works to either side, the wing nuts are loosened and the idler drum is re-adjusted as in Fig. 4.



Duplicate Collars Cut Quickly With Double-Feed Setup

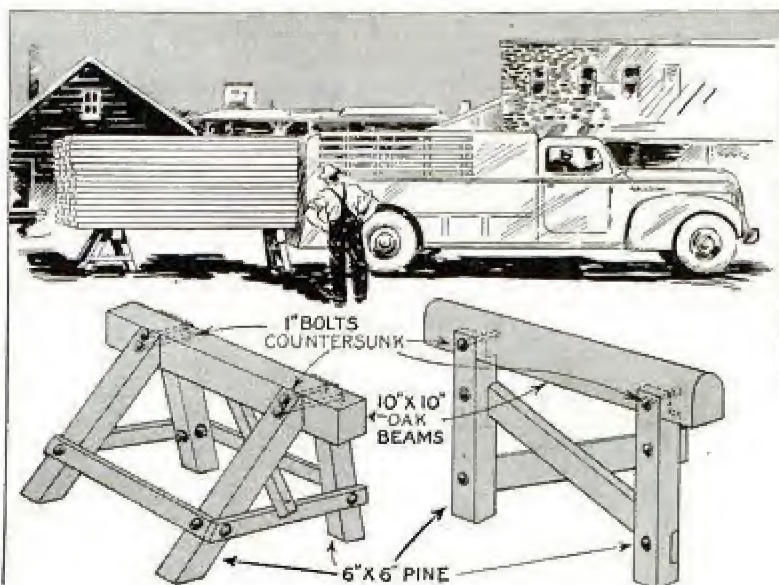


Producing duplicate collars from a steel bar is a simple matter with this lathe setup. First, turn a collar to fit the tailstock spindle and machine a flat on it for attachment of a parting-tool stop. This is made from a piece of steel and has a square opening in the free end to take the parting tool. In use, the drill is advanced against the work after which the parting tool is set so that it just clears the left side of the stop opening. This determines the width of the collar and both tools can then be advanced at the same time as the drill will be stopped automatically when the parting tool touches the right side of the square stop opening.

Lumber Loaded by Backing Truck Under It

By using these trestles, a lumber company of St. Louis, Mo., is able to load a truck with five to six thousand feet of lumber in 5 min. This permits them to handle their increased business, due to defense orders, with their regular truck fleet as no truck has to stand idle for some time while it is being loaded a piece at a time. The load is merely piled on the trestles by workmen while a truck is making a delivery, then on its return, the driver backs under the new load and is on his way again.

As you will notice, the front trestle is a vertical one that is pushed over easily as the truck backs under the load, which then drops onto the first roller of the truck body, enabling the driver to back under the en-

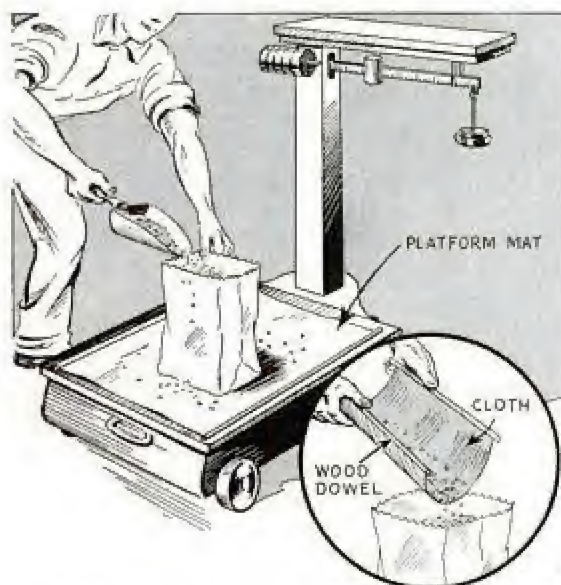


tire load. When the truck reaches the rear trestle, which is braced at an angle of 45 degrees to keep it from tipping, the load is moved the remaining few feet onto the truck with the body-roller hand cranks.

Cloth Mat on Scale Platform Recovers Spilled Grass Seed

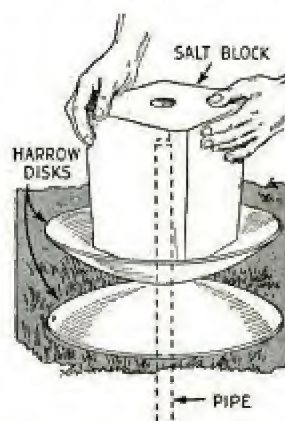
One seed dealer, who filled many orders for small quantities of grass seed, found that frequently some of the seed was lost by being spilled on the platform of the scales as a bag was being filled. To avoid this loss, he made a cloth mat to lay on the platform. The cloth, slightly smaller than the scale platform, had a length of dowel

tacked along opposite edges to facilitate handling it. When seed was spilled during the weighing, it was recovered easily by lifting the cloth and doubling it to pour the contents into the sack.



Economical Holder for Rock Salt

To hold blocks of rock salt with the greatest economy and cleanliness when provided for animals in pastures, one farmer drives a length of pipe into the ground and drops a pair of discarded harrow disks over it as shown. As most blocks of rock salt already have a hole drilled through the center when they are purchased, this arrangement prevents their dislodgement by the animals and keeps them from being soiled on the ground.



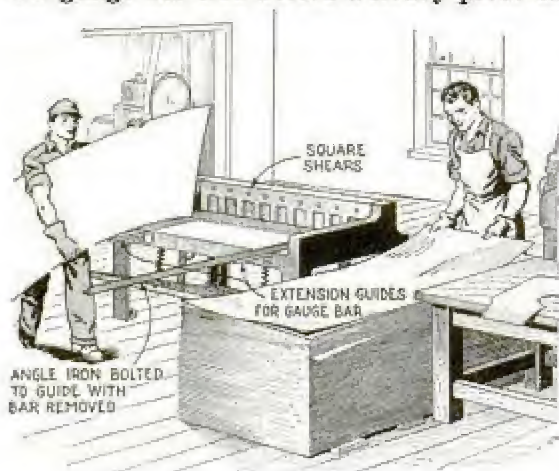
Ash Tray Holds Paper Clips On End of File Drawer



If you work in an office and do a lot of filing, an auto ash tray fitted with a vacuum cup will be just the thing to use for a paper-clip holder. The vacuum cup provides a quick means of attaching the tray to a drawer front and the clips will be at hand when needed.

Angle-Iron Guide on Metal Shears Helps Square Large Sheets

When obtaining large sheets of sheet metal from the manufacturer, we find that the ends are sometimes uneven, and with the small square on our shears, it is almost impossible to square the ends accurately. To overcome this difficulty, we removed the gauge bar and bolted a heavy piece of



angle iron on one of the extension guides at right angles to the knife. With this arrangement, it's a simple matter to use the angle-iron guide and square the ends of several sheets in a short time.

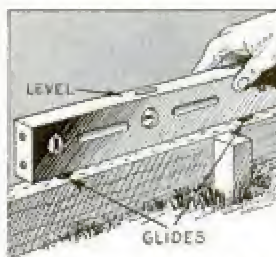
—Homer Sweany, Beech Grove, Ind.

Feed-Cooking Kettle Supported By Old Auto-Wheel Rims

Needing plenty of draft for a fire under a feed-cooking kettle, one farmer supported it at the desired height with auto-wheel rims. Three rims were set in the ground at an angle so that the kettle could not slip off them.



Level Fitted With Feet to Use It Accurately on Rough Surfaces

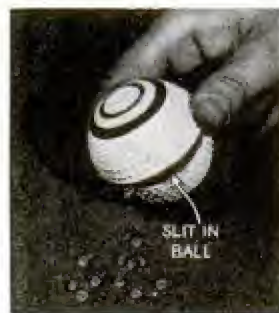


with a couple of furniture glides, which served as feet. With this arrangement it was only necessary to clean a place on the work on which to rest the feet.

For leveling concrete forms and other work where the surfaces on which the level must rest are likely to be rough, one contractor fitted the level

Rubber Ball Used as Container To Carry Tacks in Pocket

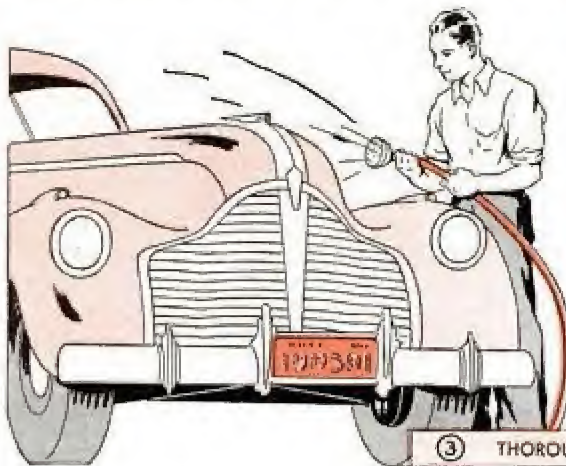
One window decorator who uses tacks in assembling crepe-paper decorations carries the tacks in a hollow rubber ball. A short slit in the ball is opened by squeezing to remove the tacks as desired, after which it closes automatically. The container can be carried in the pocket with safety.



KEEP YOUR CAR LOOKING NEW

CLEANING and waxing your car must be done correctly if the results are to be satisfactory. If the surface is coated with road grime or dried mud, wash it thoroughly, Fig. 3. Don't use a stream of water under high pressure. This will drive the dirt and fine grit right into the finish. Use a sprinkler head on the hose and open the valve less than halfway, directing the spray against the body at an angle. If you don't have a hose, an ordinary sprinkling can will do. It's better and quicker than a cloth or sponge, and there's no danger of scratching the finish.

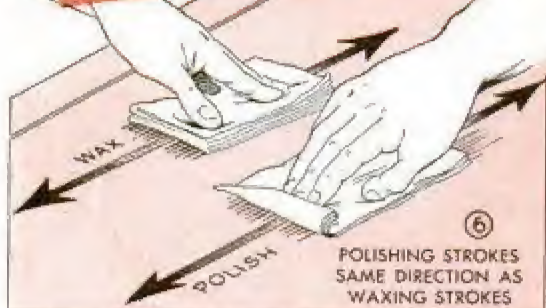
Immediately after washing and before the water dries on the surface, take up the surplus water with a chamois, Fig. 4. Then let the surfaces dry and you're ready for the wax. Use either the liquid or paste form. If you have time to polish your car frequently, liquid wax is your best bet as it takes less time to apply. However, it may not last as long as the paste. If you clean up the car occasionally, the paste wax is best as it leaves a thick coating that will protect the finish longer than the liquid wax. Both the applicator cloth and the polishing cloth should be of a coarse mesh, such as cheesecloth, or open-mesh polishing material which is woven especially for the purpose. You can obtain this cloth inexpensively at service stations and auto accessory stores. Never use an or-



③ THOROUGH WASHING IS IMPORTANT



Dry with a chamois



BE SURE THE CHROMIUM IS DRY

inary cloth of tight weave for the surface will quickly glaze over, making it impossible to apply the wax or polish it to a high luster. The applicator cloth should be folded into a pad of five or six thicknesses and about 4 in. square, Fig. 2. Take care that no abrasive particles get on the cloth and scratch the finish.

Apply the liquid wax according to the manufacturer's directions. A cloudy, humid day is best for waxing a car as the wax does not dry too rapidly. If you must do it on a clear, dry day, work in the shade. While polishing, shake out the cloth pad frequently to remove the powdery accumulation, refolding to the same size and thickness. Polish with long, uniform strokes as in Fig. 8. Excessive pressure while rubbing is unnecessary. Both liquid waxes and polishes have the property of removing a certain amount of road film and dust as they are applied. Unless the car is badly spotted with mud it will not be necessary to wash it each time you shine it. Simply wipe off the dust with a soft, dry cloth of the open-mesh kind; tightly woven cloth rubbed over grit is likely to cause scratches. Tightly-woven cloth has more of a tendency to pick up and retain tiny particles of grit, which then act as an abrasive.

Applying the paste waxes is just as simple and easy, if you watch the details carefully. There's no necessity for making a hard, tiresome job of it. You use the same applicator and polishing cloths, but with the paste waxes the applicator pad must be wet with water and then wrung out. In picking up the wax with the pad, hold the latter stationary and turn the can as in Fig. 5. Don't press hard on the pad, just lightly, so that it will pick up only a small quantity at a time. Now apply the wax in light, straight strokes as in Fig. 6, covering only a small panel; never more than 2 or 3 sq. ft. at a time. Then immediately—and this is the trick—follow with a dry cloth to spread the film of wax uniformly, picking up any excess. Have the applicator pad in one hand and the "following cloth" in the other as in Fig. 1. Let the wax stand for a minute or so while you're applying some to another small area. Then

Polish with long strokes

rub down the first with a clean, dry, polishing cloth. You'll find that it takes only a few long, sweeping strokes to give a glass-smooth surface and a high luster. Don't bear down hard on the polisher. Continue the same procedure and watch the timing between operations. That's the important thing in handling paste wax. If it gets a bit too dry before polishing, simply go over the area lightly with the applicator and polish down immediately. Or, if it does not dry fast enough, causing the cloth to stick and drag slightly, wait a little longer before polishing. On curved surfaces such as in Fig. 10, you can save yourself a lot of extra work by rubbing across them at right angles to the curve instead of up and down, or the long way of the curve.

Chromium-plated surfaces are waxed in the same way as the body, Fig. 7. If you've washed the car, be sure the chromium is thoroughly dry, otherwise you'll have trouble in getting a uniform coating. Drops of water will collect on the lower edges and overhanging surfaces, and keep the wax from adhering and spreading uniformly over the plated surfaces.

Wax and polish the dash and interior trim last, Fig. 9. Use a smaller pad and apply the wax sparingly. On older cars that have not been polished for some time, and the finish is dulled and roughened, you'll have more work renewing it. First comes a thorough washing. Follow with a prepared cleaner, which comes in both paste and liquid forms, to remove the loosened pigment and discoloration. Cleaners are usually mild abrasives, so handle them carefully on corners and edges. Apply with a pad of the same cloth you use for the wax, rub lightly, and stop when the finish begins to brighten up to its original color. After you've gone over the car, wash it with a gentle spray from the sprinkler head and dry with a chamois. If there are still some dull spots use some cleaner and again wash away all traces of it. Washing with a sponge and neutral soap after the first cleaner application often helps. Then wash the whole car thoroughly to remove the soap. Although it will still be dull the finish should come back to a fairly uniform color after this treatment. Under



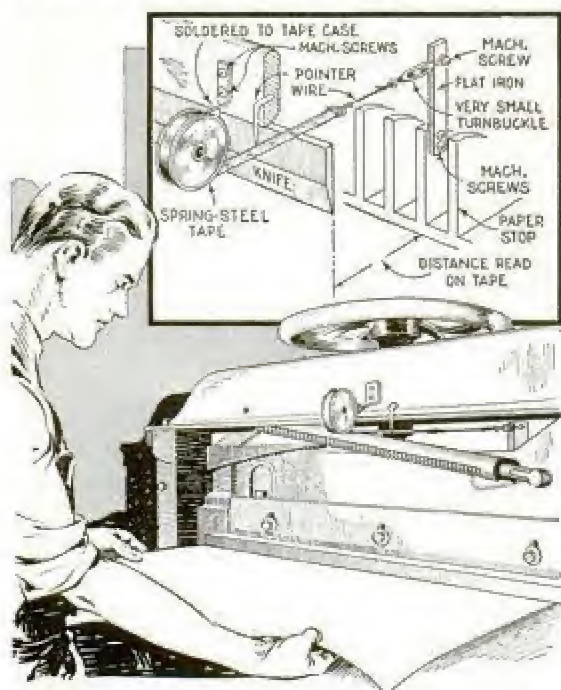
WAX THE INTERIOR LAST



ON CURVED SURFACES RUB ACROSS
NOT UP AND DOWN

these conditions the paste wax is best, although either the liquid wax or the polishes will give good results. Likely it will take two or more applications to build up a uniform luster. Proceed in the same way as you would with a newer car, except that possibly you will have to change applicator cloths more often as they are likely to become charged with loosened pigment and glaze over.

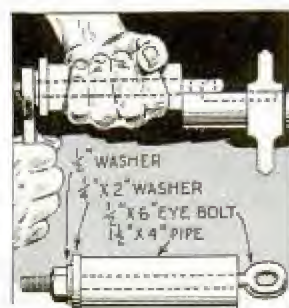
Accurate Gauge for Paper Cutter Made From Steel Tape Measure



After making a number of mistakes when using my paper cutter, which is not equipped with a gauge, I removed the stop mechanism from an old spring-steel tape measure and mounted the tape on the cutter so that it could be used to set the paper stop accurately. The tape was held horizontally and fastened to the paper stop by means of a length of wire secured to the tape end and a small flat-iron upright screwed to the stop as indicated. To provide fine adjustments, a turnbuckle was installed between the tape end and upright, after which a pointer was fitted on the cutter frame so that the gauge could be adjusted accurately.

—James F. Gardner, Chicago.

Puller to Loosen Gib-Head Keys



Gib-head machine keys are loosened easily with this simple puller, which is assembled from a couple of washers, an eyebolt and a short length of pipe. In use, it is only necessary to

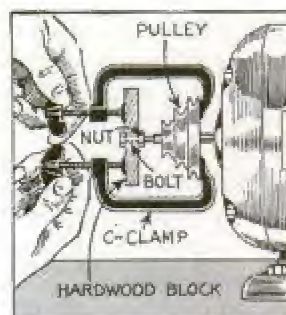
slip the bolt eye over the key head and place the pipe end against the shaft, as

indicated, so that pressure is applied on the key by tightening the nut. If welding facilities are available, a steel plate may be welded on one end of the pipe in place of the large washer to provide greater strength for loosening the toughest keys without bending or marring the heads.

—Tom E. Dougherty, Torrance, Calif.

Tight-Fitting Pulleys Removed With Two C-Clamps

Next time you have difficulty in removing a tight-fitting gear or pulley from a shaft, try this improvised puller, which is nothing more than a couple of C-clamps and a hardwood



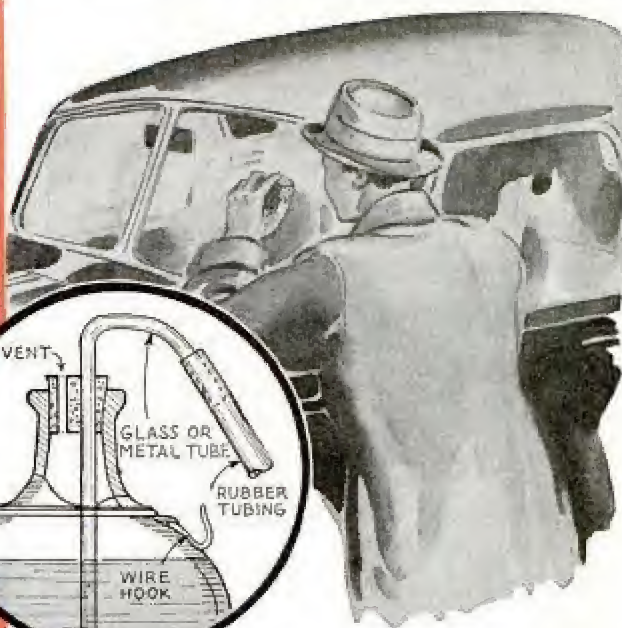
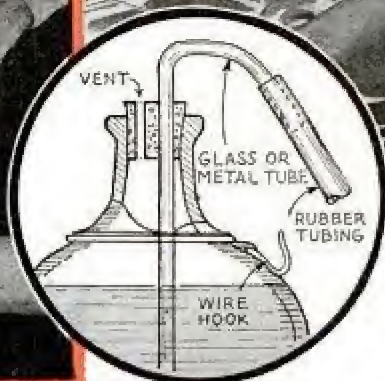
block fitted with a bolt and nut as shown. In use, both clamps are hooked over the gear and the hardwood block centered on the shaft end so that tightening the clamps applies pressure behind the gear.

Surveyor Uses Bottle Caps As Markers on Highways

When surveying roads and streets paved with asphalt or similar material, one group of surveyors uses bottle caps as markers on the pavement. The caps are held in place with long nails, and were found much better than chalk marks, which were easily erased by traffic.



Handy Siphon Wets Sponge to Clean Windshield



In private garages where a water supply is unavailable, this handy siphon will be just the thing for wetting sponges and cloths to clean the windshield, headlamps and windows. It consists of a 1-gal. jug, a cork, and a glass or metal siphoning tube fitted with a length of rubber tubing. Flow

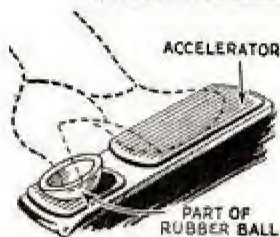
of water is controlled by pinching the end of the tube, and the stream is stopped by raising the tube above water level. When the siphon is not in use, the end of the rubber tube is hung on a wire hook slipped over the jug neck.

—Walter E. Burton, Akron, Ohio.

Maps on Truck Doors Help Driver Locate New Customers

When fastened on the inside of delivery-truck doors as shown, city and state maps are always at hand for references when serving customers. Drivers can mark regular routes on the maps for convenience and new customers are located easily before closing the doors after a delivery.

Heel Plate on Auto Accelerator Made From Rubber Ball



To help a woman driver keep her foot on the accelerator when wearing high heels, one motorist fastened half of a hollow rubber

ball at the lower end of the accelerator as shown. The ball serves as a socket in which the heel is rested. Being flexible, the socket will not mar the heel.



Writing Supplies on Cardboard Carried in Suitcase Lid



The trouble of digging through his suitcase for stamps, envelopes and other letter-writing supplies is eliminated by one salesman who keeps all these items on a large piece of heavy cardboard that fits snugly inside his suitcase lid. Half of the cardboard accommodates a blotting pad while the other half has envelopes of various sizes glued on it to hold stamps, paper clips, etc. Besides keeping these supplies together, the cardboard also serves as a handy lap desk when traveling on a train.

Removable Steel Plate on Anvil Avoids Chisel Marks

If you place a steel plate on an anvil while using a cold chisel, fit the plate with a piece of flat iron bent to the shape shown



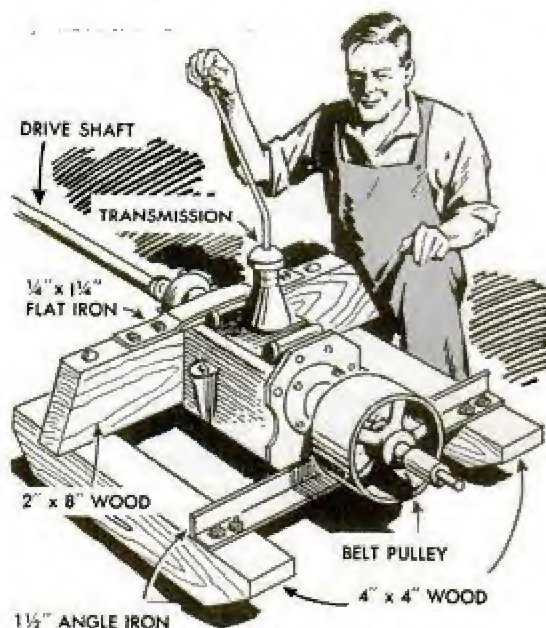
so that it will slip into the hardy hole with a spring action. The flat iron will keep the plate in place, yet allow it to be removed or replaced easily.

Feed Basket Set in Old Tire Not Easily Overturned

To keep an animal from overturning its feed basket or water bucket, place it in the center of an old auto tire. This serves as a good base which will last indefinitely.



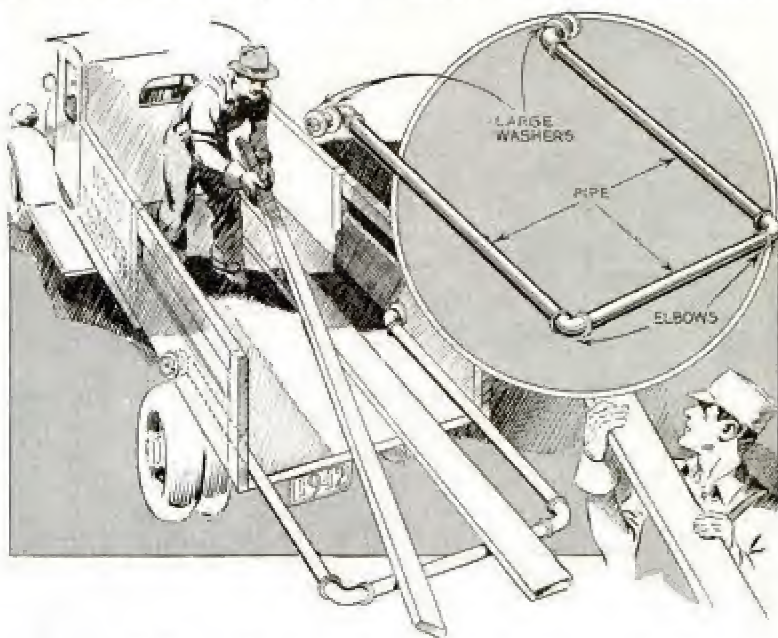
Auto Transmission Serves as Jack To Regulate Speed of Elevator



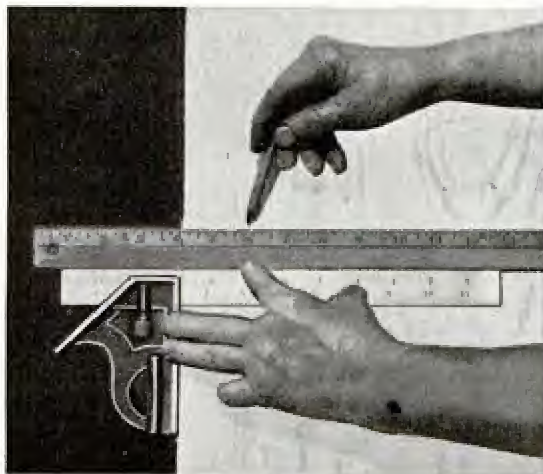
One farmer rigged an efficient speed jack from an old auto transmission to drive his grain elevator at the required speed with an engine. The transmission used was of the type having a torque-tube drive and the enclosed shaft was used as a drive or "tumbling" rod, the outer end being connected to a universal joint on the elevator. A belt pulley was fitted to the splined clutch shaft on the opposite end of the transmission and the whole unit was mounted on an improvised frame of wood and angle iron members assembled as shown in the illustration.

Extension for Truck Body to Haul Long Loads

By fitting this folding extension on the body of a small truck, one lumber company could use it on deliveries consisting of only a few long boards or planks that would be too long for a short body, thus saving a trip for one of their large trucks. The extension is made of large pipe and fittings, and is pivoted through holes in the sides of the truck. When not in use, the extension can be folded forward toward the cab where it lies flat on the bottom of the body out of the way.



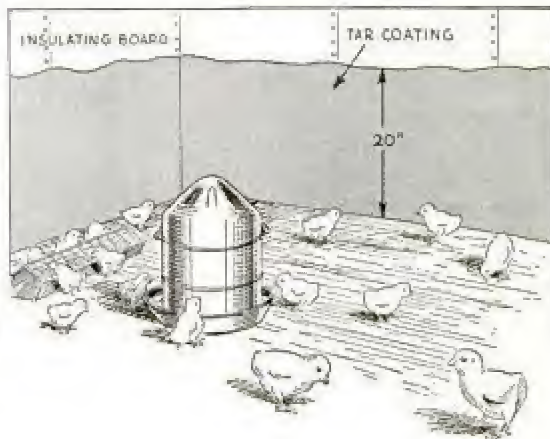
Combination Square and Yardstick to Mark Large Work



If a carpenter's square is not at hand when you want to mark a plywood panel, a yardstick and a combination square or try square will serve as a substitute. The blade of each square is just long enough to keep a yardstick straight when held against it firmly while marking across the stock as shown.

Tar Coating Prevents Chicks Picking Insulating Board

The habit of small chicks to pick at the insulating board on the side of their brooder can be avoided by coating the board with tar. Asphalt roofing coating is ideal for the purpose, and should extend to a height of about 20 in. above the floor.

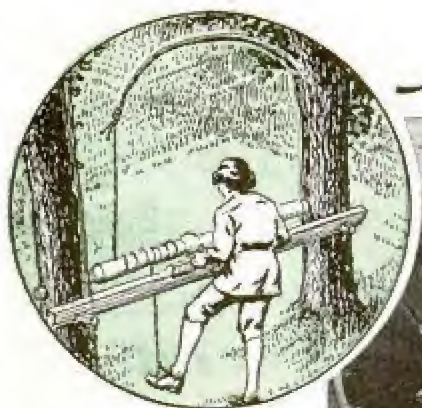


Split Sections of Rubber Hose Make Rack for Lathe Chisels

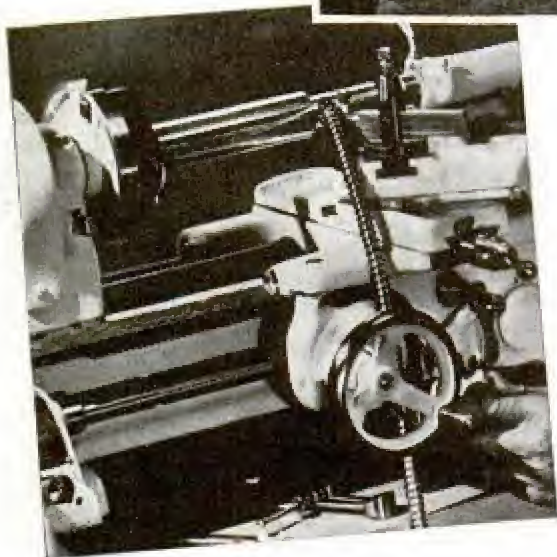
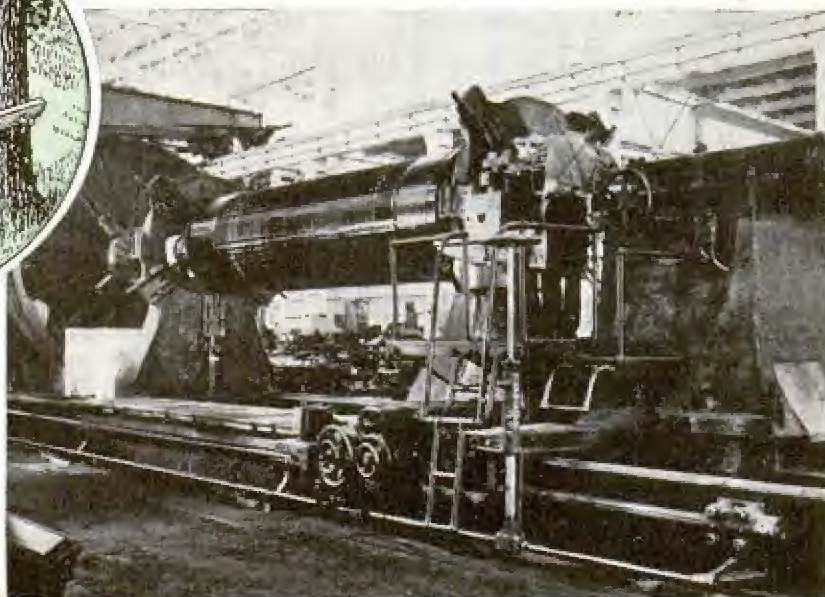
A handy rack for your woodturning chisels may be made by splitting a length of garden hose and tacking the halves back to back on a shelf as indicated. The chisel blades wedge between the hose surfaces where they are easily removed or replaced.



Metal-Turning.



From crude beginnings such as the tree lathe, modern metal-turning lathes have developed to machines of high precision. Monster at right is what Henry Ford calls his "watchmaker's lathe"



Part 3 of series dealing with basic machine tools and how to use them

AFTER getting acquainted with the parts of a metal-turning lathe and the fundamentals of lathe operation, the prospective lathe operator should undertake a serious study of various phases of lathe practice such as correct centering, methods of mounting work, technique of sharpening and positioning tools, cutting speeds, how to use precision measuring instruments, characteristics of metals to be turned, screw-cutting, taper-turning, boring, knurling, grinding, and the use and care of lathe accessories and attachments. Vol-

umes of information have been written on these subjects and obviously a comprehensive coverage of lathe practice cannot be contained in a single article on the subject. For this reason it is suggested that a number of textbooks be purchased, which will give you information covering the entire field. As this information is so readily available, and also because many articles have already been published in *Popular Mechanics* regarding various phases of lathe practice, this article will only give general data on terminology, methods of testing a lathe for accuracy, how to tackle some specific problems such as the turning of eccentric bearings on crankshafts, mounting small and large-size tubing, cross-drilling, taper-turning and filing, besides giving a few useful hints for lathe operators.

Keep your lathe accurate: It's a good idea to test your lathe frequently because its accuracy is of the highest importance. When testing the headstock and cross slide for squareness, some machinists regularly take a chip off the faceplate. However, it is preferable to make an 8-in. auxiliary faceplate such as is detailed in Fig. 2, which will prove valuable for many jobs besides making this test. It should not be less than $\frac{3}{4}$ in. thick. Two holes for locating pins and two for machine screws are drilled through both the auxiliary and the regular faceplate so that the auxiliary plate can be

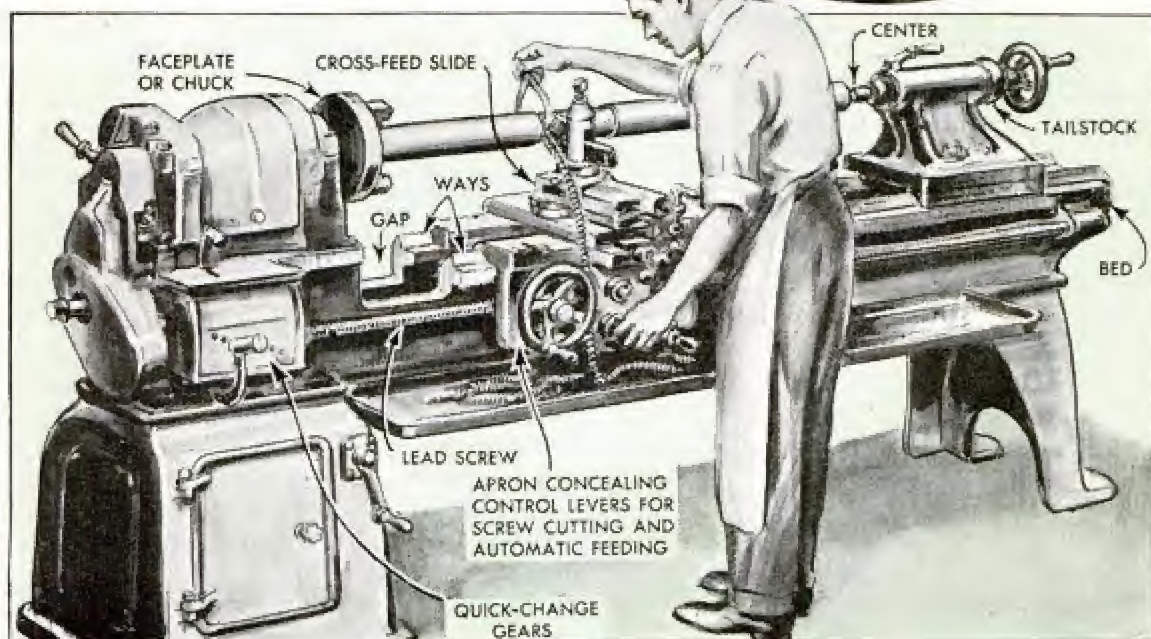
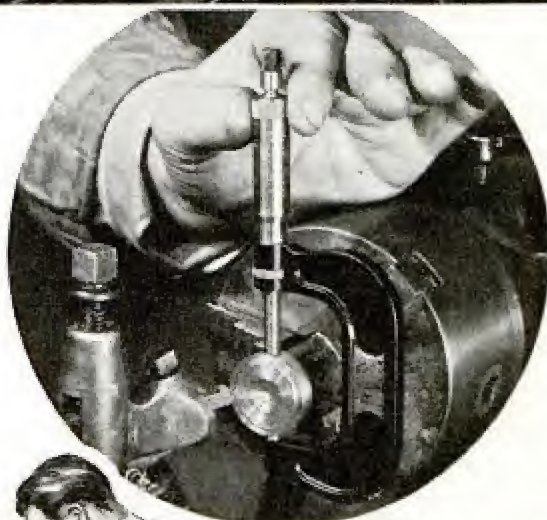
LATHE SET-UPS

America's vital industries depend on thousands of lathe operators for work that must be turned to a high degree of precision. The lathe is one of the most important machine tools, essential in making all other power tools used in production lines

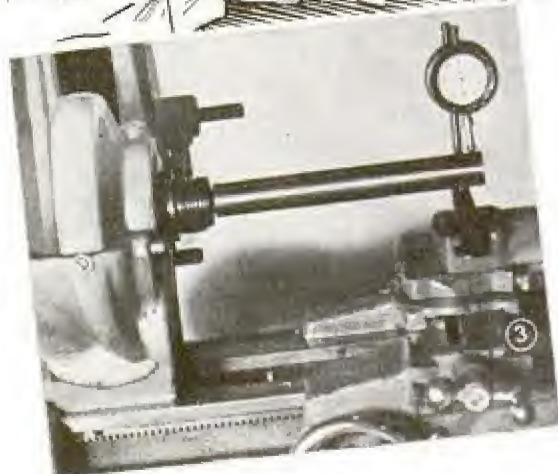
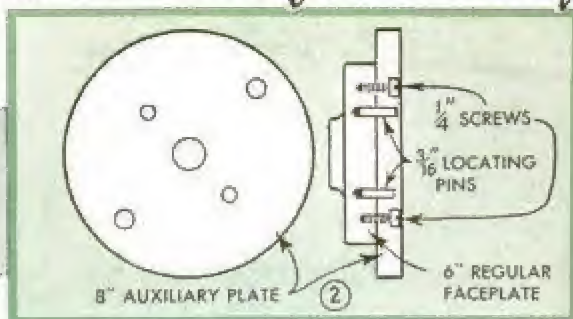


By H. J. Chamberland

attached easily in a few minutes. The two screw holes in the regular faceplate are tapped. After the plates have been assembled, a very light cut is taken across the auxiliary plate, the test for squareness between headstock and cross slide is made with a machinist's rule or straightedge and a piece of paper .001 in. thick, as shown in Fig. 1. The edge of the rule is held against the plate and if the strip of paper can be pushed under the rule at the center of the plate, the surface of the latter has a concavity. A .001-in. concave surface is permissible, but not a convex surface, which is indicated if you can slip the piece of pa-



Check the lathe for accuracy

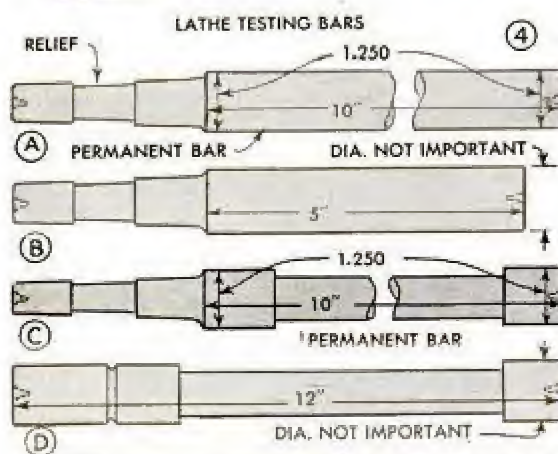


per under one end of the rule when the other end and center contact the faceplate snugly. If the test shows a convex surface, it will be necessary to make a careful check-up of the cross-feed slide and also of the headstock if the latter is not equipped with roller bearings.

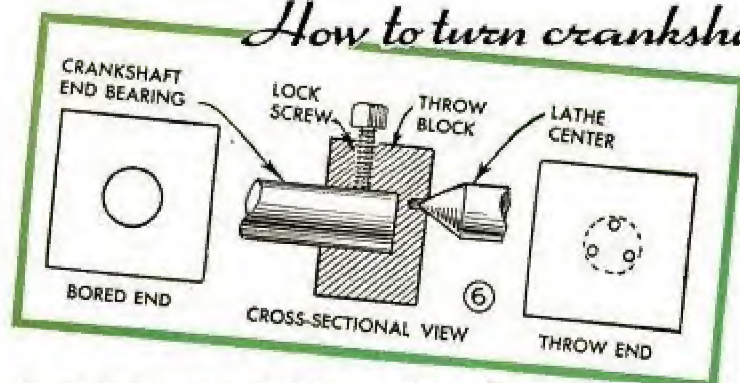
In testing for accuracy of alignment between the headstock spindle and the ways, you can make use of an accurately finished bar fitted to the spindle bore as shown in Fig. 3. This test requires a dial indicator. The bar should be made as shown in detail A of Fig. 4. With the dial indicator attached to the tool holder of the carriage, the test should be made at both ends of the bar, vertically as well as horizontally. There should not be a variation of more than .001 inch.

Another testing bar such as shown in detail B of Fig. 4 is used to make the boring test. A cut about .003 in. in depth is taken across the bar, and if micrometer measurements show only .001 in. or less of taper, boring results should be quite accurate.

The headstock-tailstock alignment test illustrated in Fig. 5, is made with a bar such as the one shown in detail C of Fig. 4. This bar, which should be finished with precision, is used to check up wear of tailstock resulting from constant sliding action. A variation in height of .001 in. or less shows a very good condition in this respect. Although a .002 or .003-in. low tail point will not affect straight turning badly, it will be a handicap when tapers must be turned accurately. If you are in the habit of turning tapers by offsetting the tailstock, it is a good idea to check alignment after returning the tailstock to the center position, by means of a testing bar such as shown in detail D of Fig. 4, the bar being set on centers and its trueness checked with the dial indicator. Note that the testing bars A, B and C are tapered to fit the headstock spin-

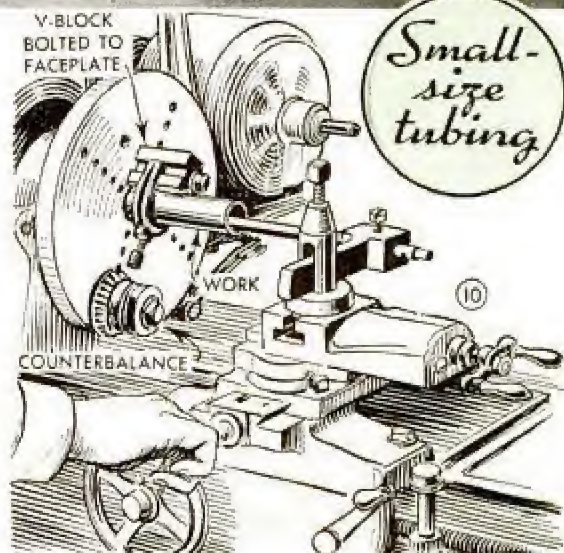
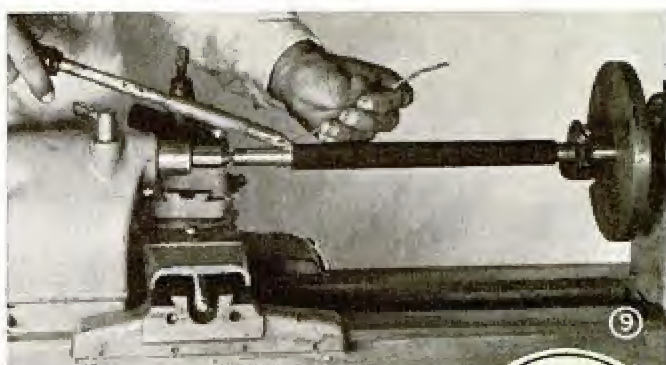
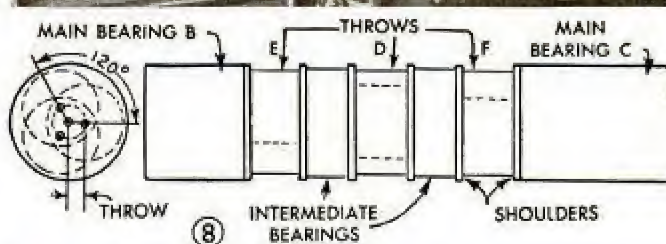


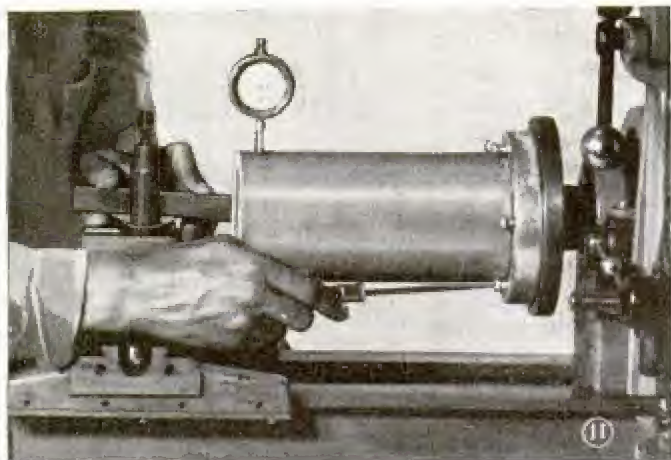
How to turn crankshafts



ble while D is intended for use between centers.

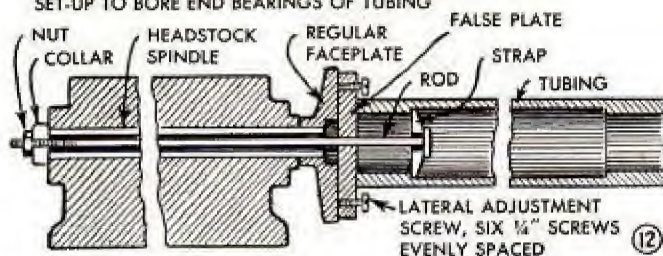
Turning crankshafts: Crankshafts made in large quantities are forged, but in smaller lots they are turned from billets with the use of throw-blocks. Throw-blocks consist of two identical and usually square pieces of steel machined as shown in Fig. 6, after which they are hardened. One side of these blocks is bored for the turned end bearings of the shaft. On the opposite side are center-drilled holes corresponding to the throws in the shaft and their offset in relation to its center. Single or triple-throw crankshafts such as shown in Fig. 7 can be turned by the procedure shown in Fig. 8. The idea is to scribe the required number of evenly spaced lines at both ends of the periphery. This is done by fitting the shaft with an improvised dog, using the dividing means of the headstock and then scribing with the end of the tool bit. These lines must intersect others on the ends of the shaft drawn radially with the centering piece of a combination square. Thus, a circle corresponding to the desired offset or radius is formed on both ends, and throw locations are prick-punched accurately and then center-drilled. It is well to undercut in order to differentiate intermediate bearings, end bearings and throw bearings. To turn a similar crankshaft, take the intermediate bearings first, main bearings B and C next, and shift to throw centers for D, E and F. Bear in mind that you must bolt some scrap piece onto the faceplate to properly counterbalance the work. Each throw requires a new balancing set-up. All throw-bearings and intermediate bearings should be rough and finish-turned with the same





Large-diameter tubing

SET-UP TO BORE END BEARINGS OF TUBING

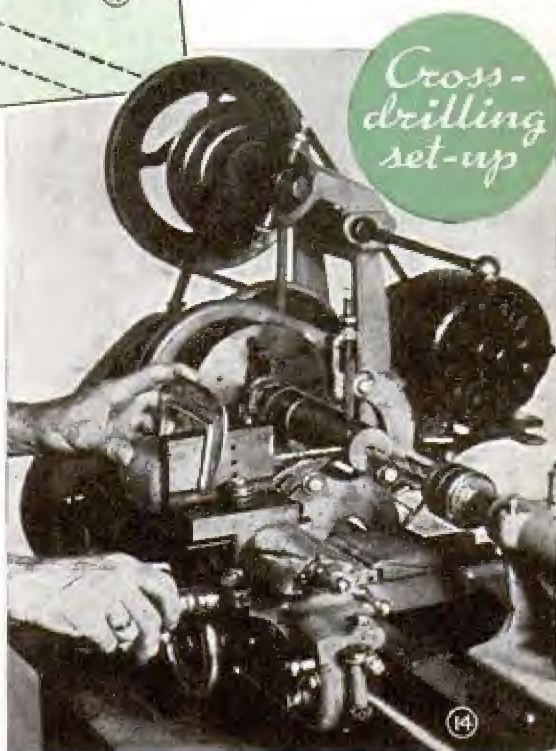
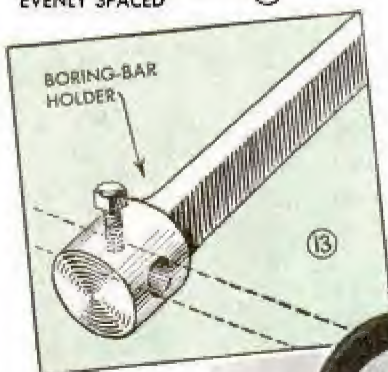


set-up. It is advisable to leave the end bearings slightly oversize previously and take a final cut. No counterbalancing is needed for concentric bearings.

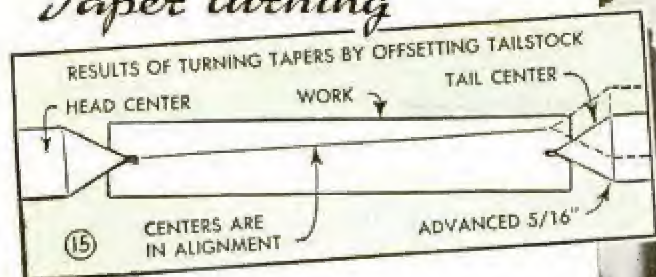
Avoid waste by using tubing: Great savings in material are possible by using seamless steel tubing, which is available in many diameters and wall thicknesses to meet exacting industrial requirements. The economy lies in the fact that internal and external dimensions in premachined state are very accurate and an ample variety of sizes permits machining with a minimum amount of waste. Sections of thin-wall tubing to be machined externally can be soldered to an improvised mandrel as shown in Fig. 9. The mandrel must be turned perfectly straight to a very light press fit in the tubing. The ends of the mandrel are undercut for soldering convenience. A cut of .005 in. can be taken this way with accuracy. Lengths of thin-wall tubing not exceeding 4 in. can be lightly bored as in Fig. 10. The tubing is clamped to a V-block and the assembly is in turn trued concentrically on the faceplate. Note the convenience of the tapped holes in the supplementary plate

for bolting such parts to it. In such a set-up scrap parts are bolted to the plate to counterbalance the V-block.

Large-diameter and thick-wall tubing are frequently used for such items as collars, reliners, sleeves, bushings, housings, machine columns and hundreds of similar parts. For example, Fig. 11 shows a piece of tubing, 8 in. long, 4 in. in diameter and having a 3-in. bore. The hole was recessed previously, leaving bearings at each end. The purpose in the illustrated set-up is to bore the bearings $\frac{1}{16}$ in. larger, but separately, holding both in perfect alignment. This work is not complicated and is executed as follows: As shown in Fig. 12, the tubing is held to the false plate by means of the strap and rod, the latter passing through the headstock spindle and tightened with nut against a collar or heavy washer. The false plate should be about $\frac{1}{2}$ in. thick, smaller in diameter than the regular faceplate and should have a hub for a .005-in. play in a centrally counterbored hole in

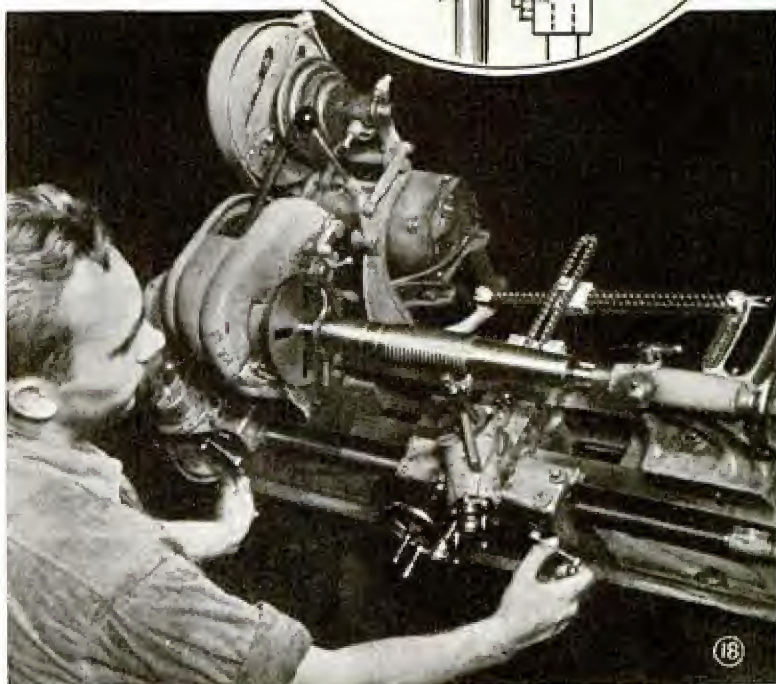
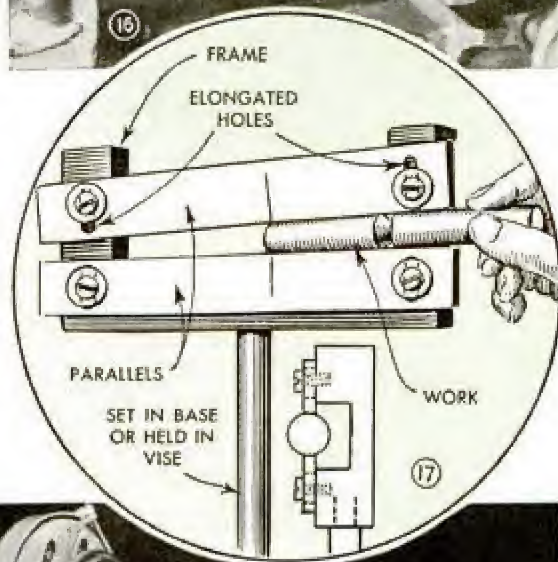


Taper turning



the faceplate. Also, the false plate has six 1/4-in. tapped holes about 5/8 in. from its outer edge for lateral adjustment screws. The tubing is tightened against the false plate just enough to true up with the dial indicator by tapping with a small chunk of lead. The end against the plate is trued first and then the indicator is moved to the front end. If there is any eccentricity here it is soon corrected by slight increase in pressure of one or two of the screws positioned opposite the high location on the work, which is done as illustrated in Fig. 11. After tightening the nut on the rod and again checking for concentricity, the hole is bored to desired size and the end of the tubing is faced. Then the cycle is repeated for the opposite bore, starting all over again after having released the screws bearing against the faceplate.

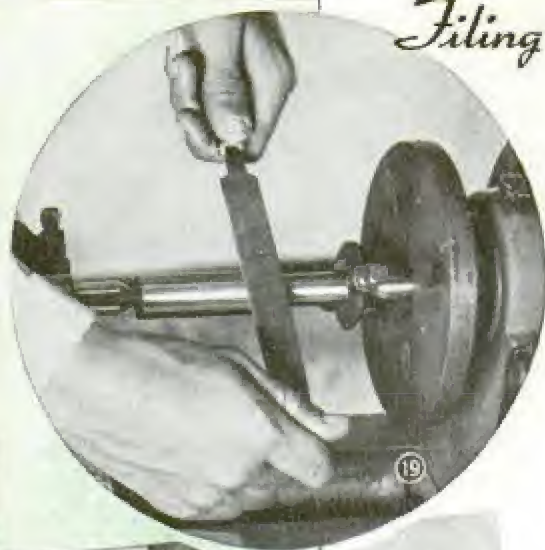
Boring-bar holder and cross-drilling set-up: A boring-bar holder is shown in Fig. 13. Such holders are most economically made of soft steel, cut to shape on a metal-cutting band saw. This saw is also of great help in cutting out disks that are to be turned to exact size in the lathe, thus eliminating considerable waste of metal in the form of chips. An arrangement for cross drilling is shown in Fig. 14. Using the conventional set-up to drill the end hole, the right-angle operation is done by chucking a drill in a small portable drill or grinder, bolting an angle plate to the cross-feed slide and then clamping the motor to the angle plate after centralizing.



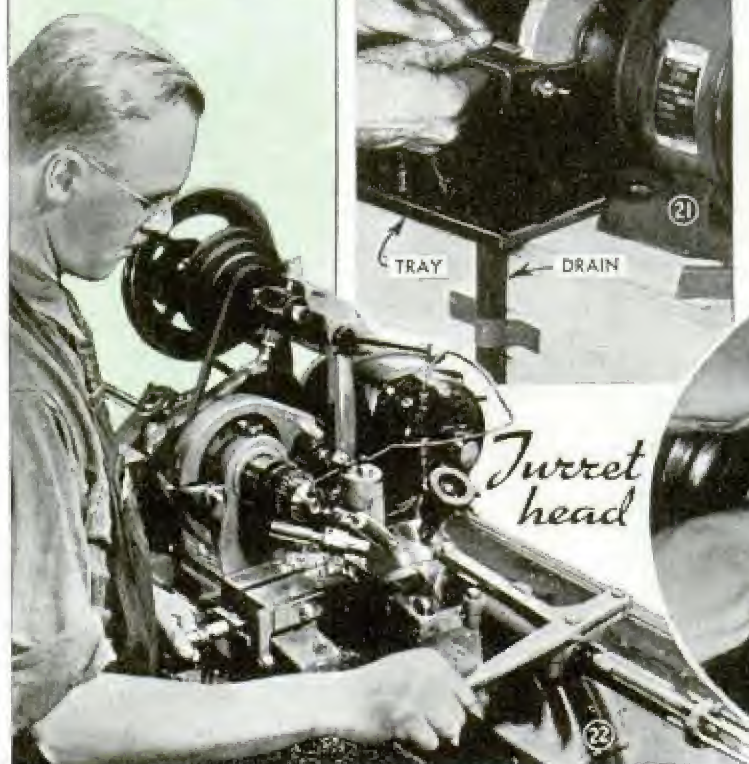
Any number of holes may thus be spaced accurately and drilled at any location on the periphery of a cylindrical part.

Taper work: Turning tapers is a very important lathe operation. Much of this work is done by offsetting the tailstock center but Fig. 15 shows what really happens when using this method, which obvi-

Filing



Water fed on grinding wheel keeps tool bits cool



Turret head

ously is somewhat detrimental to machine centers and also to center holes in the work. Many machinists prefer to use the compound slide as shown in Fig. 16, which results in a better taper due to increased rigidity. First rough-turn the tapers and then allow about .010 in. for finishing cuts. Fig. 18 shows a lathe equipped with a production taper-turning attachment. This device is attached to the rear of the lathe and causes the cross-feed slide to travel parallel to its tapering adjustment.

Shown in Fig. 17 is a taper-testing fixture which is dependable and economical. The setting is done with a plug gauge or with taper shanks of drills, reamers or end mills. The chief requirement is that the bearing surfaces of both parallels be lapped into each other for accuracy. Recessing all taper shanks of tools such as shown in detail A of Fig. 4 is highly recommended, but it is not necessary to so recess lathe or other machine centers.

Filing in lathe and grinding tools: Fig. 19 shows the left-hand method of holding a file on work rotating in the lathe. This position may be somewhat awkward at first but it is very effective in keeping your fingers away from the dog. Fig. 20 shows the usual position of the hands where they are likely to be injured.

Getting tool bits hot when grinding them and suddenly dipping them in water is not good practice; it is a sure way to damage a high-speed steel tool. One way to avoid this is to provide a wet-grinding set-up as shown in Fig. 21, in



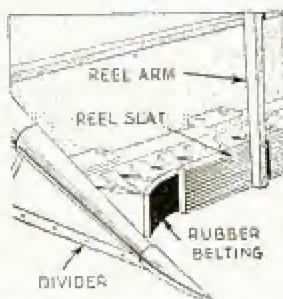
which a stream of water is fed onto the grinding wheel and a shallow tray is provided underneath, the tray being connected to the drain. If you do not wish to connect directly to the water supply line, set up a 5-gal. can about 18 in. above your bench grinder.

Turret attachments: Fig. 22 shows a production attachment for bench lathes, known as a turret head. It holds a number of different tools such as a center drill, twist drill, reamer, tap, button die, etc., and saves considerable time otherwise consumed by replacing one tool with another when using a chuck. Fig. 23 illustrates part of a larger machine known as a regular turret lathe, which is a high-production tool.

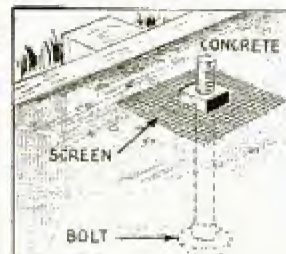
Next month: How to Use a Bench Shaper

Flexible-Reel Slat Extensions Prevent Combine Clogging

Under certain conditions straw tends to collect on the dividers of a combine harvester and cause trouble by clogging the machine. To avoid this, one farmer screwed short lengths of old rubber belting to the ends of the reel slats as shown. The belting extensions were allowed to project just far enough to strike the inner sides of the dividers at each revolution of the reel. This sweeps the dividers clear at all times, preventing any accumulation of straw.



Supporting Bolts in Wet Concrete



When it is necessary to anchor a bolt in freshly poured concrete, one contractor supports it in position with a piece of screen wire. First, the bolt is placed in the concrete in the desired position, then the wire is slipped down over the threaded end and the nut is started as shown. In this way, the wire serves as a float to keep the bolt in a vertical position until the concrete sets.

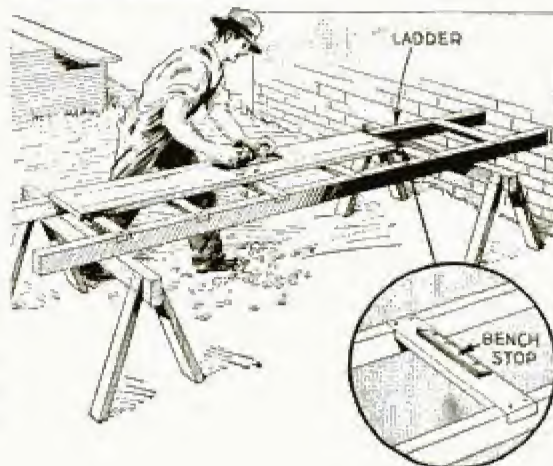
Trap Door in Hay Loft Marked By Suspended Auto Tire



Hung from the ceiling above the trap door in a hay loft, an old auto tire provides a good marker to prevent anyone from accidentally walking into the door. Even in the dark it is possible to locate the tire which is swung aside when passing through the trap door.

Ladder Serves as Handy Bench While on Small Jobs

Instead of hauling a workbench along when working on small jobs, one carpenter uses his ladder and sawhorses to make a satisfactory bench. The ladder is placed so that one end butts against a wall or building and a bench stop or hardwood block is screwed to one of the rungs for use in planing boards as shown.



Fabric "Brooms" on Hand Truck Clean Path for Wheels

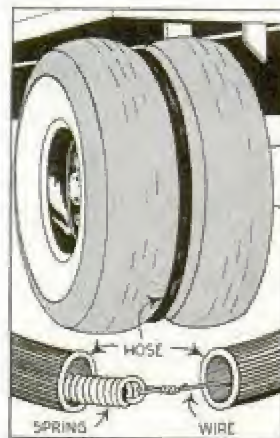


On loading platforms and floors where dirt or gravel may obstruct the wheels and make a hand truck hard to push, loops of

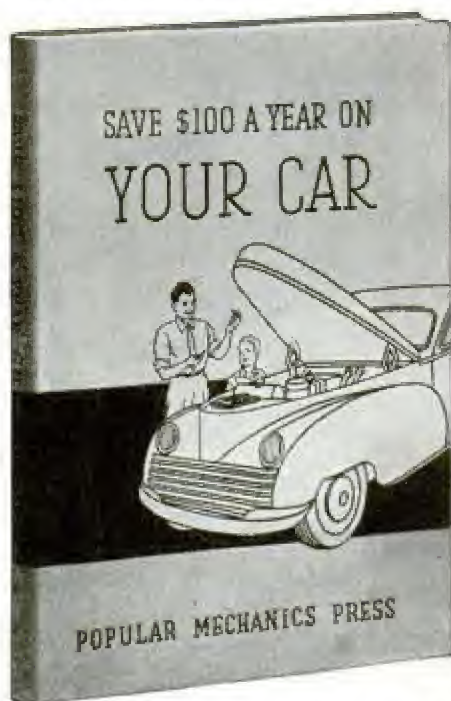
fabric belting can be nailed or bolted to the truck frame to clean the floor in front of the wheels. The belting loops should be suspended so that they touch the floor with a firm pressure when the truck is pushed.

Rocks Wedging Between Tires Avoided by Garden Hose

Placed between dual tires, a length of hose of suitable diameter will keep stones and other objects from lodging between tires on a dual-wheel truck. After cutting the hose to the right length, put a screen-door spring and a length of wire inside it. Make the spring-and-wire assembly a little shorter in length than that of the hose. Put the hose in place and then stretch the spring so that the wire can be fastened to it as shown.



HOW TO MAKE YOUR CAR LAST LONGER



Here's how you can save money and still do your bit toward Victory, help conserve essential war materials and at the same time add thousands of miles to the life of your car. Popular Mechanics new automobile guide, "YOUR CAR," gives you hundreds of easy, practical kinks. Besides, it is filled with pictures and contains hundreds of time, money and labor-saving short cuts.

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Radio

Recorded Bugle Calls on P. A. System

By P. B. WOOLLEY

EVEN the bugler is mechanized in present day national defense. In the dimly lit hours of the morning, at one of the large Signal Corps School and Replacement Centers, a soldier reluctantly steps out of bed and goes to a turntable where he sets a needle on a recording and the martial strains of "First Call" blare over a 20-speaker public address system, arousing the Post.

With defense expansion requiring barracks to

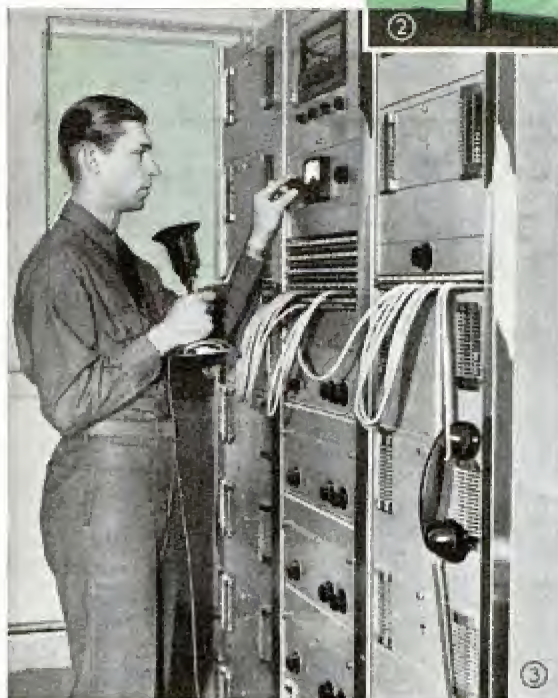


house thousands of men beyond normal peacetime strength, the area of such reservations has spread beyond the range of the powerful lungs of the chestiest buglers in the Army, despite the aid

offered by giant megaphones through which they formerly did their tooting.

The P. A. system beats out the meter of the soldier's life from early dawn until the stars twinkle to the rhythm of "Taps." Photo 1 shows Private Allen Richter starting a "First Call" recording; in No. 2 we see Private James Maratta, of Columbus, Ohio, patrolling his post in the area where one of the 4-unit speakers is located. Private Richter is at the main control board of the system, photo 3, where he is making an amplification adjustment in preparation for using the microphone. These soldiers and the P.A. system are on 24-hour duty and ever on the alert to carry out orders and inform the Post of any emergency which might arise.

The 20 all-weather type 100-watt speakers are placed at strategic points in the barracks area and near the parade grounds.





"VEEP" A.C.-D.C.

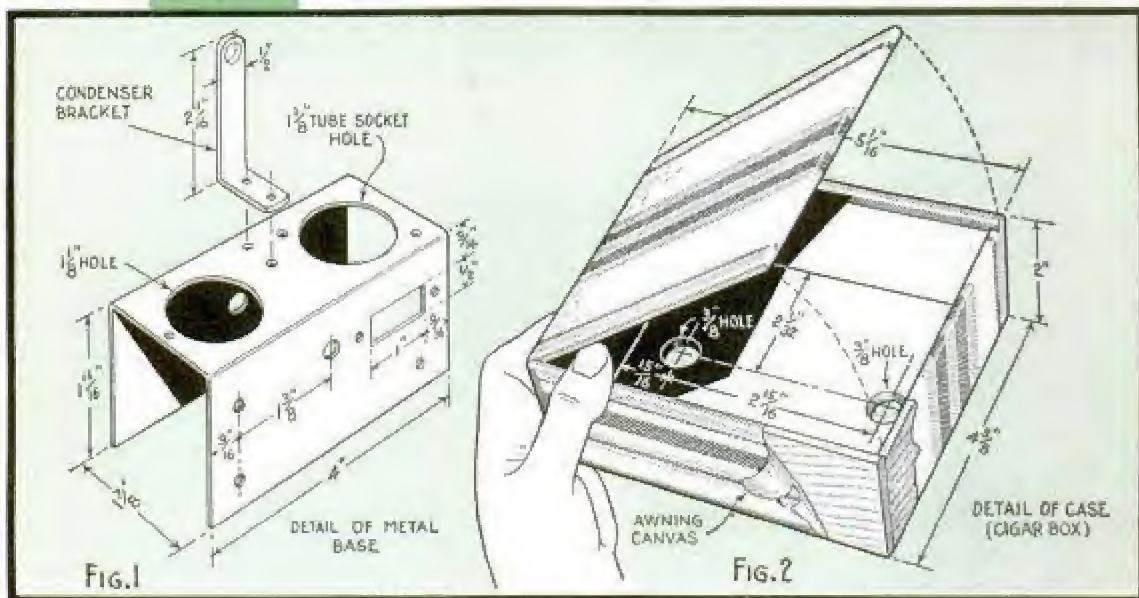
By E. L. Blanchard

VERY small, and always ready for instant use, this tiny low-cost emergency receiver works on any 110-volt line and helps you to keep posted on the latest news, air raid warnings and important programs when larger sets are not immediately available. There are no batteries to go dead; you can tuck the set into your pocket for listening in at the plant, office or home at odd times.

Rugged and ultracompact, it employs a minimum of inexpensive parts including a hand-wound coil. Assembled on the simplest kind of galvanized-iron base, formed by clamping the sheet metal in a vise, and housed in a miniature cigar box of well known brand, this "Veep" emergency receiver is one of the smallest all-electric sets ever designed for home construction.

All base and case details are given in Figs. 1 and 2; the cigar box or plywood box of the same dimensions, is covered with lightweight striped awning canvas and this is varnished to make it

waterproof. Further details are clearly shown in the various photos, especially in the front view of the case in photo A which shows the metal dial plate tacked to the front cover over the mounting hole for the tuning condenser. The chassis base is mounted on its side in the box and is held in place by the nut and washer on the volume control shaft.



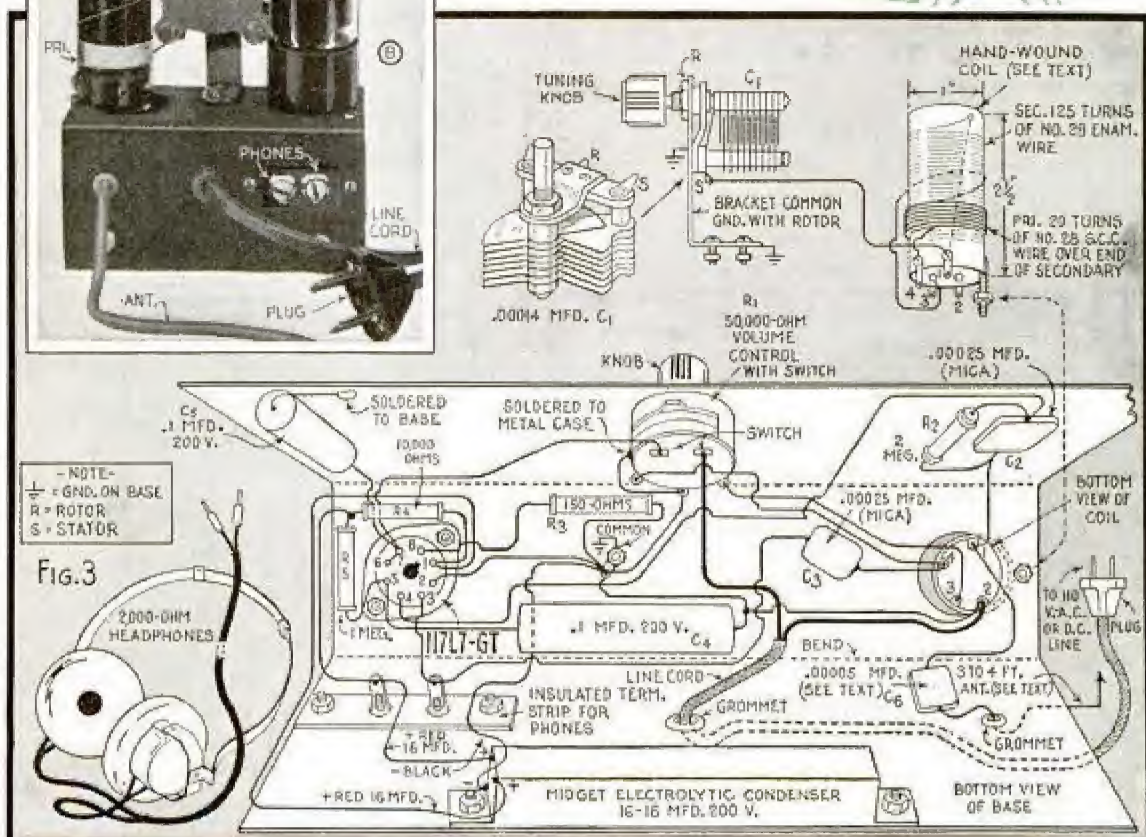
BROADCAST RECEIVER

**FITS IN POCKET
WEIGHS ONE POUND**

Drill and cut all holes in the flat piece of sheet metal before bending it in the vise. It is suggested that the hole to pass the power cord should be drilled in the top of the base directly under the tuning condenser, rather than in the rear.

A simplified wiring diagram, showing every part and connection below the base, and all connections to the coil and tuning condenser mounted above, appears in Fig. 3. The coil winding details are shown in this diagram; the coils are both close-wound in the same direction. The 20-turn primary coil is used as a tickler and is wound on the lower end of the secondary over a piece of Scotch tape. A standard Bakelite or fiber coil form 1 in. in diameter

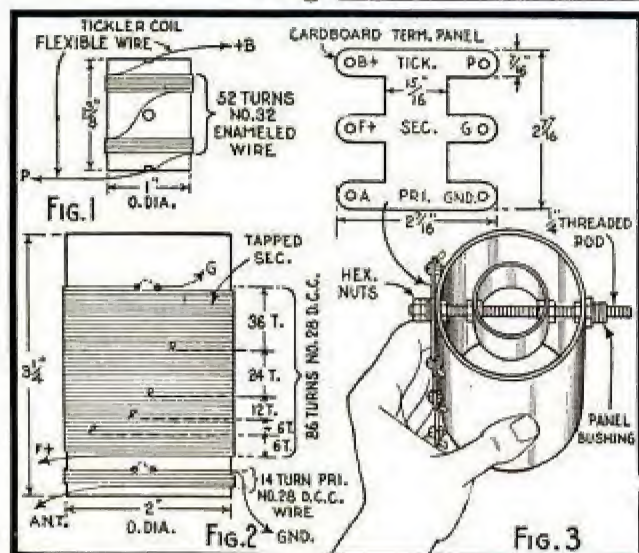
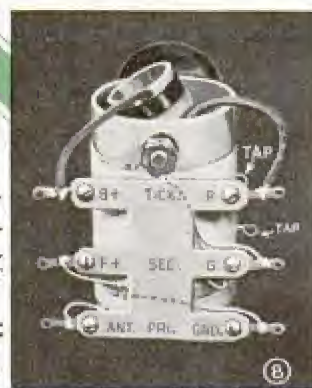
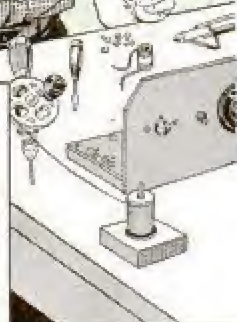
(Continued to page 181)



"Roll Your Own" All-Wave 3-Circuit Tuner



(A) Front view of completed 3-circuit tuner; (B) Rear view of terminal panel; (C) Schematic circuit diagram as used in 3-circuit receiver



ANYONE can make a tapped-coil three-circuit tuner which is the heart of many simple receivers designed for beginners and experimenters. This popular type of tuner has primary, secondary and variable tickler windings. It is tapped for short waves as well as for standard broadcast reception, and flexible tickler-coil leads provide positive contact connections under rough handling. A cardboard terminal panel simplifies receiver circuit connections as each terminal is clearly marked.

This three-circuit tuner may be employed with a 350, 365 or 370-mmfd. variable tuning condenser, and it is the same type that is specified in beginner's receivers R-275, R-289 and R-298, described in recent issues of Popular Mechanics Magazine. The parts will be found in practically every radio experimenter's junk box, and cost only a few cents.

The coils are all close wound in the same direction, as detailed in Figs. 1 and 2. Standard size Bakelite tubing, with $\frac{1}{16}$ -in.

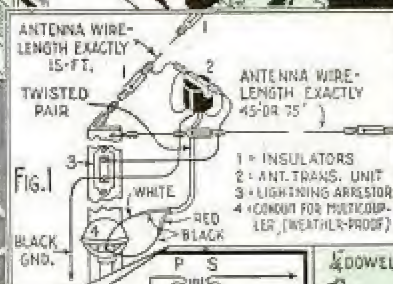
wall was used for the model; however fiber or even shellacked cardboard tubing of the same dimensions may be used instead of Bakelite if desired. The tickler coil is wound with a total of 52 turns of No. 32 enameled wire as indicated in Fig. 1. Drill a hole through the center of the small form to pass the $3\frac{1}{4}$ in. length of $\frac{1}{4}$ -in. 20 threaded brass rod, and then drill two small holes near each end of the form to anchor the winding. Scrape the enamel from the ends of the wire and thread it through the small holes. A 3-in. length of flexible stranded cloth-covered wire is then soldered to the anchored coil ends which are to go to the soldering lugs P and positive B on the cardboard terminal panel as shown in photos A and B.

Now prepare the large piece of tubing for the primary and tapped secondary coils. Drill the shaft holes $\frac{5}{16}$ in. down from the top end, and begin the secondary winding $\frac{5}{8}$ in. down from this top end. Drill two small starting holes, and leave 3 or 4 in. of wire at the start and finish of each winding. Wind the primary and secondary with No. 28 d.c.c. wire as

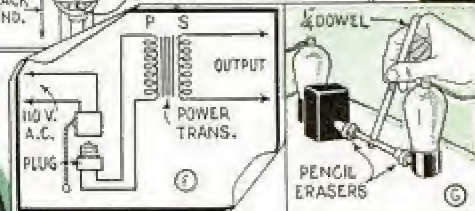
(Continued to page 183)

Helpful RADIO HINTS

(A and B) Multicoupler antenna system for apartment houses now includes FM with noise-free broadcast and short-wave reception. Roof installation details are given in Fig. 1. The radio receptacle multicoupler unit is shown in photo A mounted in a dual receptacle outlet for each apartment. The antenna transformer unit and other parts appear in photo (B). One of the largest eastern apartment communities has over 12,000 such radio outlets



(C) Crystal pickup tone equalizer; connected between the pickup and amplifier, rotary switch provides 4-point control. (D) Aids for code students: No. 1 is a code practice oscillator with dynamic speaker; No. 2 an additional speaker and No. 3 a compact earphone audio oscillator

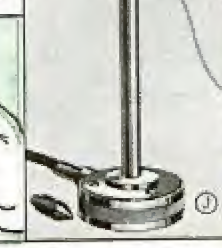
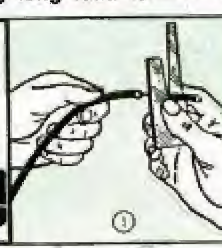


(F) "Dim-a-Lite" socket makes low-cost substitute for an expensive power rheostat for reducing line voltage to small power pack. Transformer primary leads are soldered to a screw plug. (G) Tapping hammer used to locate defective tubes and poor connections; check with resulting speaker noise

(H) Many set owners increase receiving range with this bi-directional two-antenna arrangement. Stations barely heard on one come in strong on the other. Connect switch arm terminal to receiver antenna post

(I) Handy 5-in-1 wire-stripper-tool. (J) Vibration type crystal pickup for oscillograph machinery testing

(E) Condenser nut wrench for easy removal or tightening of electrolytic condenser mounting nuts; 2-in. steel socket provides room for passing long lead terminals



Allen B. Hu. Mont Laboratories
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Blackout-Panel Oscillograph Minimizes Eye Strain



Designed for use under adverse lighting conditions or in total blackness when necessary, this oscillograph employs a specially processed steel panel treated with a non-radioactive luminous paint that retains its maximum luminosity for several minutes after exposure to ordinary light. The glow is the same color as the screen of the cathode-ray tube used in the instrument, thus minimizing eye strain.

'Tweeter' Speaker Added for FM



If you have a good, properly baffled speaker you can add one of the so-called tweeter speakers, which operate only on the highest audio frequencies, and build up a response in the high range for full reproduction of the wide band of frequencies available on FM broadcasts. Tweeter speakers are made in a number of different varieties and are mounted in the manner shown. When

combined with a 12 or 15-in. speaker in a bass reflex cabinet, frequency-modulation (FM) programs are correctly reproduced.

Portable Set of Advanced Design

Operating on its own self-contained batteries when desired, as well as when plugged into a light line, this portable receiver brings in not only local stations but short-wave radiocasts from foreign lands. It is equipped with two loops and a 5-ft. telescoping antenna.



Compact Phono Oscillator

When used with a modern record player, this tiny unit is capable of faithful reproduction through a radio receiver without wired connections. With this same combination, owners of home recording phono-radios can copy their favorite recordings.



Blueprints covering simplified radio construction articles in this and past issues are available for 25c each. Many popular tested circuits to choose from. Original detailed parts lists with names of supply sources, can be obtained from Popular Mechanics Radio Department upon receipt of postage.

NEXT MONTH—Two Tubes Equal Four in an Economy T.R.F. Set. One of a (V) home series designed with a minimum of parts along simple standard lines. Has built-in speaker, good volume and range, and operates on 110 volts a.c. or d.c.
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Mechanics of a Blackout

(Continued from page 43)

safe. Most subways are close below the street surface, and would be much more vulnerable in air attack than the deep-level tubes of the London system.

Hotel managers scratched their heads in perplexity over the blackouts. Public rooms could be darkened by turning out lights or putting curtains over windows. Guests rooms, however, were not under the management's direct control. To pull the main switch and plunge the whole building into darkness was considered impracticable. Though effective in results, it would hardly be in accord with the tradition that guests must be handled with tact; moreover, there would have been a considerable element of actual danger in suddenly cutting off all lights and stopping the elevators. Instead, the hotels distributed blackout notices to guests asking them to extinguish room lights or to pull down the curtains. Watchers outside spotted the windows that remained lighted and hurried messages were dispatched to those rooms to put out or conceal the lights.

Fire and police apparatus are being equipped with shaded lights for use during alarms. In one city a guard was stationed at each fire alarm box in the downtown area to prevent any false alarms. At Seattle the police radio transmitter was cut off when a light switch was opened during the blackout. No messages could be sent from headquarters to the radio patrol cars. In another town, municipal authorities found they had 635 gas-burning street lights, each of which had to be turned off individually. At Toronto the fire sirens were used to give the blackout signals. When a real fire occurred in a blackout,

sirens of fire apparatus responding to the alarm were believed to be the "all clear" and many lights were turned on again.

While efforts here have so far been directed toward making blackouts complete, some authorities question the desirability of total darkness. Dr. Samuel Galloway Hibben, director of applied lighting for the Westinghouse Electric & Manufacturing Company favors "dimouts," leveling lights to the quality of moonlight.

"Total darkness during air attacks," he says, "can cause more civilian casualties than bombs. Normal eyes require about 20 minutes to adjust themselves to blackness so that the faint outlines of objects can be seen at close range. Lighting of less than moonlight intensity does not make it any easier to find the city from the air nor to identify particular spots, but it does help greatly in preventing accidents."

To maintain essential traffic during air raids it has been suggested that police carry portable, shielded traffic lights strapped to their shoulders. A band of white is recommended for the bodies of autos and trucks with cat-eye slits in headlights and small running lights suspended under the chassis. Fluorescent paint excited by ultraviolet light can illuminate subway entrances, police stations, bomb shelters, hospital entrances, fire hydrants, cross-walks, curbs and clothing. Another development is a low-power argon lamp with a reflector which would prevent the light being visible from the air.

Blackout or dimout, the problem is new to the people of the United States. We must learn what to do and what not to do when the sirens shriek.

Training the Glider Army

(Continued from page 85)

glider pilot maneuvers to keep his craft on or very near the ground until the plane gets into the air, keeping the cable connecting the two fairly taut. As the plane starts to climb, the glider pilot follows it until both are free of the ground.

A sailplane towed by an airplane, which is the method visualized for mass transportation of troops by air, must be piloted, just as is the airplane. Piloting skill for the glider operator is essential, in order to re-

lieve the airplane pilot of the excessive manual effort necessary for control of his ship, burdened as it is with the load at the other end of the cable. Moreover, improper flight or position of the towed glider is likely to endanger the towing airplane and cause it to stall, due to its low flying speed on a towing job. From the towplane pilot's standpoint, the first 1,000 feet of climb are the most dangerous. During this phase he

(Continued to page 164)

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must maintain as much air speed and as shallow a climb as possible. If he stalls at this low altitude, due to insufficient air speed, he has little chance to recover.

But after 1,000 feet he increases his angle of climb, and flies close to the stalling speed, gaining altitude rapidly in this way. All the while the glider pilot must give his tow pilot every cooperation.

Air gusts affect the light glider greatly, so its pilot must watch the power plane ahead for advance warning, as the glider hits the same bump right on the heels of the tow plane. The glider pilot, thus forewarned, cushions the action of the bump by nosing up or down, keeping the tow line at as nearly the same tension as possible.

The most dangerous place for a sailplane during a climb is down and to the left behind a towplane, where the propeller throws the air it displaces. Here the slipstream and disturbed air create an area of turbulence so great that a sailplane that ventures into it is almost unmanageable. The best place for the sailplane is directly behind and even with the towplane, or slightly to the right and sufficiently high that the tow ship appears slightly behind the horizon.

Major General Henry H. Arnold, chief of the Army Air Forces, revealed something of the army's attitude toward gliding when he stated: "I have heard it said that the United States Army did not wake up to the military possibilities of gliders until after Crete. The facts are that we have been studying gliders and their possibilities for a long time, but it takes a long time to set a large machine in motion." He said further that gliders "may spell the difference between success and failure" in many military missions.

The Navy has ordered sailplanes utilizing a new material, a wood-impregnated plastic, said to possess the advantages of not picking up moisture or fungus growth; of being light, durable, and capable of being worked into any shape, and of having a "long fatigue limit" that enables it to withstand strains, twists, shaking and the like without cracking or chipping. Some of the Navy's gliders will carry 24 men each, some 12 men, and others two men. The larger ones will have a wing spread of 110 feet and gross weight of 12,000 pounds, while the 12-place craft will have a wing spread of 88 feet and weigh 6,500 pounds.

Sports Secrets in a Flash

(Continued from page 37)

is off center. These observed rotations, and hooking and slicing spins on the ball gave Spalding physicists the idea that if this rotational effect could be regulated it would be possible to produce just enough spin on the ball to correct the flight errors



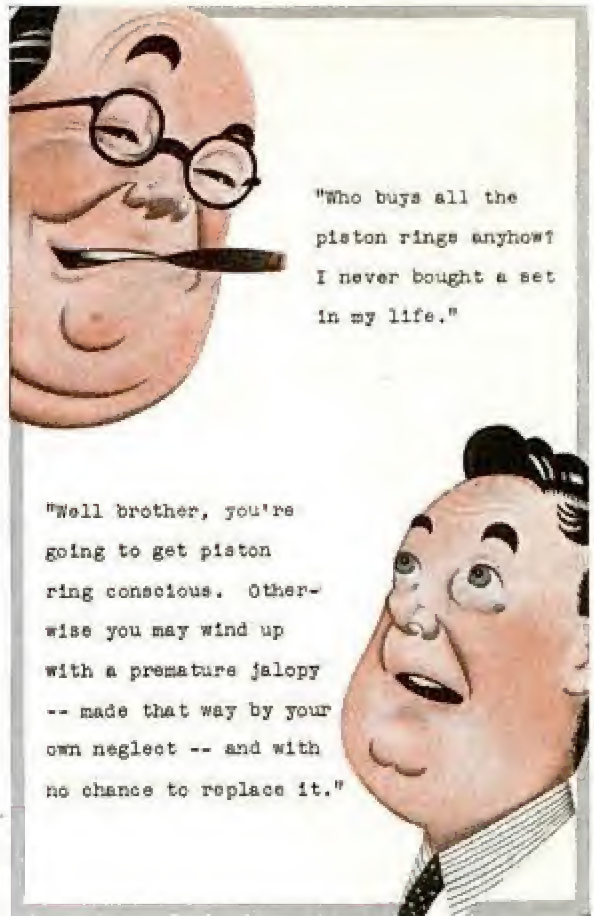
© Arthur D. Little, Inc. 30 Charles River
3/1,000,000-second shot shows ball flattened by club

due to off-center contacts. It was found that this could be done by a certain convex curvature in the club face.

Other high-speed pictures reveal to the player the futility of trying to gain extra length in drives through shaft whip at the moment of impact. Since the shaft is merely the means of imparting motion to the club head, the player's purpose should be to develop all possible speed before impact and then allow the club head to do the rest. The effort to employ the flexibility of the shaft to speed up the club head can only result in retarding the only effective striking force. During the short impact time, .0004 second, the head acts as a free projectile, the ball springing off the face before the backward bend appears in the shaft—and before the player could even feel the contact.

Another outgrowth of the Spalding research technique is use of multi-exposure photographs for comparison of golf swings. For instance, not long ago pictures of this type were made of an inexperienced golfer and of Bobby Jones. One point revealed was that the arc of Jones's backswing was wider than that of the poor player, result-

(Continued to page 166)



"Who buys all the piston rings anyhow? I never bought a set in my life."

"Well brother, you're going to get piston ring conscious. Otherwise you may wind up with a premature jalopy -- made that way by your own neglect -- and with no chance to replace it."

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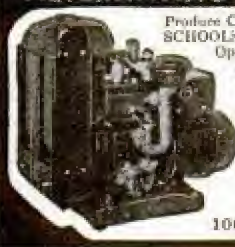
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ing from a more complete extension of the left arm. Noticeable also was a more effective windup of his hips, which brought the hands higher to provide more potential power. In addition, the radius of his downswing was shorter, through the retention of almost the full angle of wristcock during the early stages. And in the second half of the downswing, the uncocking of his wrists was seen to contribute to continually increasing speed of the club head. And finally, his relaxation after the hitting effort allowed the momentum of the swing to carry the club well around back of the neck at the finish. The poor player's swing, being much shorter after impact, indicated the player was still feeling tension.

The difference of club-head velocities near impact also was evident, for in Jones's swing the distance traveled by the club between flashes was almost 50 percent greater. The pictures were made at about 1/50,000 second, the stroboscopic light flashing 50 times per second.

Still another development is the Spalding Stroke-ometer chart, a patented method of analyzing multi-exposure photographs by means of polar coordinate plots which make it possible to tell at a glance to what part of the action any particular group of figures apply. A sheet of circular cross-section paper is laid on the multi-exposure photograph in such a way that the club head lies outside the cross-section paper. An appropriate scale is laid off on the paper and the numerical values of the property under consideration are plotted opposite the corresponding position of the club. For example, suppose the velocity of the club head is being plotted. Two positions of the head give the average velocity between these two positions. Suppose, for a given pair of positions, that the velocity is 100 feet per second. Then a point is laid off in the cross-section paper midway between the given positions of the head and at a value of the velocity which is 100 feet per second on the scale. A Stroke-ometer chart of Bobby Jones's swing, for instance, shows a steady increase in velocity for the downswing and a steady decrease for the follow through, with a sudden change at impact. Thus is revealed the symmetry of action desirable in golf.

In these, and many other ways are high-speed photographs helping to improve sports—both equipment and player.

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Operators of fleets also know the importance of maintaining equipment at peak efficiency and regularly inspect, clean and adjust spark plugs. Since the start of a national competition among fleets, for economy and efficiency of operation, Champion-equipped fleets have won a big majority of the awards.

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The Race of the "Ironing Boards"

(Continued from page 69)

had spent \$20,000 on the hunt in vain. They were given up for lost. About this time, soaked and bedraggled, in they came. It seems their boat had conked out, shipped a lot of water, and they had made the oil slick by bailing bilge water. Finally, a small fishing boat came along and the two boys hitch-hiked a ride, towing their disabled boat behind. They had gone far up the coast and in due time returned!

The Ironing Board Derby has been run just for the sheer sport of it—for the satisfaction that only a champion knows when his tired muscles rally for one last effort, and he comes in the exhausted victor. Two large cups are presented each year, one for the rider and one for the boat operator.

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Difficulties of jettisoning bombs from the big, long-range flying boats are overcome by a bomb rack just patented and assigned to the Boeing Aircraft company. The bottom of a flying boat's hull cannot be pierced by doors to the bomb bays, and moving heavy bombs out over the wide sides disturbs the equilibrium of the plane and may spoil the aim. Three Seattle engineers devised a way to arrange the bomb racks with their lower ends projecting over the sides of the hull, the upper ends sloping inboard to form an inverted V. The rack is enclosed in the sides of the plane, achieving maximum streamlining. Downward openings are just wide enough to let the bombs fall free, and there are guides to keep the bombs parallel as they roll toward the discharge openings.

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Weight, Grams	8	3 1/2	2 1/2

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How to Make Your Car Do

(Continued from page 95)

up at full speed saves gas, brakes, and tires.

For maximum mileage the tires must be kept at recommended pressures or even a few pounds above. Don't drive on car tracks and don't take turns at high speed. When a tire company test driver is told to see how rapidly he can wear down a set of tires he hunts for a high speed road that has plenty of sharp curves. Cramping the wheels against curbs and even excessive road shocks tend to move the front wheels out of line. The wheels should be checked for alignment occasionally, and at once if you notice the rubber is wearing unevenly.

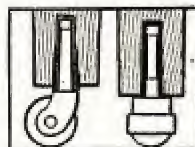
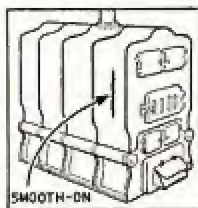
To keep your body paint in good condition, keep it clean. Dirt picks up the heat of the sun and transmits it to the finish. A dust cloth can be used to remove a slight film of dust and the car should be washed if dirt and mud has dried on it. Always wash and polish the car in the shade, when the car is cool, and never use a gritty cleaner on the finish. Most chrome plating is very thin and should be washed with water instead of with a cleaner that may wear it down.

Almost no one bothers about keeping the engine clean. Those who do, find the engine stays cooler in summer. In addition they have less trouble with dirt and dust in the generator, starter, and distributor. Once the whole engine compartment has been thoroughly steam-cleaned, you can keep it clean by scrubbing it with solvent, using an old brush. To be safe, leave the hood up afterward and be sure all the solvent has evaporated before starting the engine again. Under exceptional conditions air-borne dust in the carburetor has ruined an engine in less than 1,000 miles. Few people drive in such adverse conditions, but everyone should keep the air cleaner clean. It is recommended that the air screen be removed every 2,000 miles, soaked in gasoline to remove the grime, and then dipped in oil and drained before replacing.

The chances are you have known all of these hints, and the chances are, also, that you have failed to observe all of them. If you resolve to spend enough money on your car to keep it in good shape, and drive it reasonably, you will be surprised at the unexpected service it will give you.

DON'T WORRY

about war-time difficulties
in replacing cracked or loose
household or auto equipment
... repair with SMOOTH-ON



These days, you **MUST** keep your plumbing and heating systems, automobile, household utensils, tools and hardware in good condition, because you will find it hard or impossible to replace them until after the war.

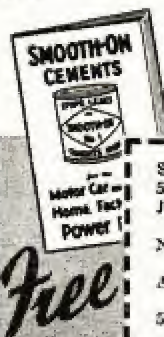
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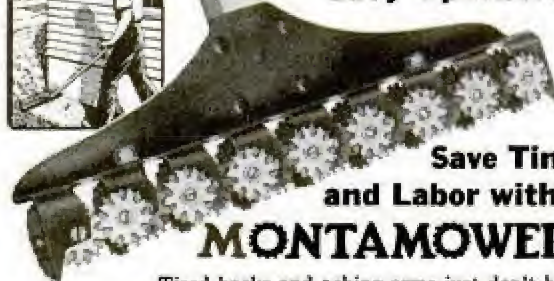
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"Tracer Bullets" of Science

(Continued from page 63)

A similar technique is employed to measure the thickness of the oil film that protects metal sheet from which tin cans are made. The average thickness of these films is about six-millionths of an inch. In other words, about 300 layers of the oil would about equal the thickness of a human hair. To measure the oil film, a small amount of a sodium compound that has been made radioactive is mixed with the oil before it is spread onto the metal. When a Geiger counter is held near the sheet, the number of radioactive explosions indicates the thickness of the oil.

Tagged atoms are likewise used to study diffusion of silver, the manner in which atoms wander about inside a piece of the metal. Knowledge of this phenomenon is valuable to such industries as metal plating, since it can reveal how much one metal will "soak" into another. Careful measurements of the motion of silver atoms in solid silver and in solid gold have been made by Dr. W. A. Johnson.

Chemical measurements can be made with the aid of tagged atoms, the tracers being employed to determine the exact amounts of chemicals required to complete various chemical reactions. For example, when magnesium chloride is added to phosphoric acid and ammonia a solid ammonium phosphate is formed. The problem is to measure exactly how much magnesium chloride is needed to consume all the phosphoric acid. Its solution begins with "tagging" some of the atoms in the phosphoric acid. As magnesium chloride is added slowly to the acid, the phosphorus atoms are released from the solution or mixture as solid material, leaving fewer atoms. A Geiger counter permits measuring the radioactivity of the solution after each addition of magnesium chloride, thus determining the percentage of phosphorus atoms remaining. With each measurement the radioactivity decreases until a point is reached where it nearly vanishes and further additions of magnesium chloride produce no further reduction. In other words, all the phosphorus has been released. Plotting the results on a graph, the scientist is able to determine the exact amount of magnesium chloride required to combine

(Continued to page 172)

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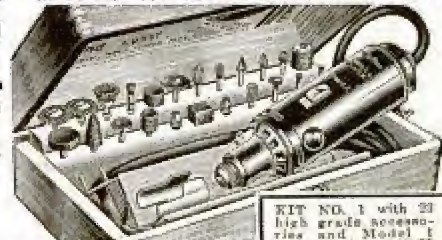
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completely with the amount of phosphoric acid he has originally. Application of radioactive tracers to improve methods of chemical analysis has been worked out by Dr. Alois Langer.

The tracer bullets and the atom-detecting instrument are useful to medical research men interested in the paths followed in human bodies by various food elements, such as iron, copper, iodine and sodium. For example, if the scientist wants to learn where sodium goes, he mixes a little radioactive sodium with the sodium in the salt a person sprinkles on his mashed potatoes. Then as digestion and assimilation proceed, the Geiger counter traces the progress of the salt through the person's body to its final resting place as a part of the body structure. Since this artificial radioactivity is only temporary, it fades in a few days without causing any bodily harm. But its use as a tracer of food elements has become a valuable tool in the study of certain ailments, such as goiter, tumors, anemia and leukemia. Work on medical applications of radioactive materials is now going forward in many research laboratories. Foremost among them is the University of California where the work is headed by Dr. John Lawrence. Other important contributions are being made in the laboratories of the Harvard Medical School and the Massachusetts Institute of Technology.

Similarly, by putting tagged atoms of carbon in plant food and tracing them, biologists have discovered that plants can make sugar in the dark—not just in sunlight, as once supposed—although the process is slower without light.

In locating radioactive atoms of phosphorus in steel, a simple "camera" made of a tin can, two small brass disks and a screw clamp was employed. Although it had no lens, shutter or other parts usually regarded as essential on cameras, the tin can recorded on photographic film the rays from the tagged atoms, thus revealing their location. This was done by molding a small disk of steel containing the tagged atoms, or tracer bullets. In a darkroom a piece of photographic film was laid on each side of the steel disk, two small brass disks or plates were placed outside the film, the whole was clamped together, then placed in the tin can to keep out all light. The next morning, the can was opened and the

21405

film developed, revealing light and dark blotches caused by rays from the tracer atoms. The light areas corresponded with little air pockets, or blow-holes, in the steel disk, showing the phosphorus had concentrated on the surfaces of these holes.

This simple method can be used to reveal the location of other substances besides phosphorus. For example, steel also contains small amounts of sulphur, carbon, manganese and silicon. Any of these substances can be made into tracers with an atom smasher.

But it is not always necessary to make atoms radioactive in order to trace their course. An atom sorter on wheels, known as a portable mass spectrometer, has been devised for sorting out by weight the molecules and atoms which are the building blocks of all matter. Research has shown that almost all elements contain a mixture of atoms falling into two or more weight groups. These weight groups are called isotopes, some of which are abundant, others very scarce. The atom sorter can detect and measure the percent of atoms in each of these weight classes, even when they are as scarce as one part in 100,000. Mass spectrometers have been the subject of research in university laboratories for many years but only recently has there been available for general use a portable self-contained instrument. This was developed in these laboratories during the past two years by Dr. J. A. Hipple.

The atom sorter does its job by shooting the atoms around a bend in a glass vacuum tube up to a speed of a million miles an hour. Just before they start they are given an electrical charge. Then they pass through a chamber where high voltage acts on the electrical charges and shoots the particles to the other end of the tube. The curved end of the tube is encased in a powerful electromagnet which bends the paths of the atoms. The lighter the atom or molecule, the more its path bends. At the other end of the tube, the percentages of particles of different kinds are measured with electric meters.

One practical use for the portable atom sorter is as an accurate, high-speed gas analyzer for oil refining and prospecting. There are possibilities that the instrument may be used to discover new oil deposits. Another field is the analysis of gases for heat-treating and hardening steel.

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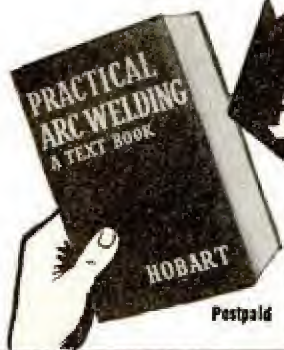
(Continued from page 76)

bridge or fortress. The third dimension cannot, of course, be translated to paper; but to the amateur viewing a Trivision film it appears almost alive, certainly alive with intriguing possibilities for both military and civil use.

In the Signal Corps photography school, rookie cameramen learn the technique of operating cameras, the chemistry of the profession, mounting prints, even the choosing of photogenic subjects. In the training film laboratory the men are divided into groups of scenario writers, animators, film editors and cameramen; each receives highly specialized training in his line. Graduates are finally assigned to photographic companies throughout the army. Some are sent to "cover" maneuvers, although training films generally require special arrangements on location, with close attention to details. If engineers are to learn bridging operations from the film, if gunners are to learn correct firing practice and tank crews the tactics of the "heavies," the demonstration on the screen must be perfect. Some subjects lend themselves especially well to animated drawings: thus the interior action and recoil mechanism of an artillery piece can be dramatized, or the invisible chain of events inside a vacuum tube can be given life, or a plan of battle can be pictured on an animated map. Slow motion, too, can be employed to teach an efficient march step, the scaling of obstacles, traffic flow or proper handling of arms.

The night has a thousand eyes, and some of them belong to the Air Forces. Flying photographers at Lowry Field are trained to use high-speed and high-altitude cameras, bomb spotters, infrared and telephoto cameras, color and reconnaissance cameras, and the new technique of night shots from the air by the light of flare bombs synchronized with the shutter.

Signal Corps photographers have been moving in a steady flow from Fort Monmouth's school to assignments throughout the army. Whether it's a pictorial history of War in the 'Forties that Uncle Sam wants, or a quick range on an enemy gun emplacement, or a sound movie to train aviation mechanics or tank crews, an army armed with lenses is ready.



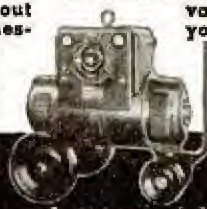
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Arming Civilians for Defense

(Continued from page 31)

the guards should be instructed how and when to burn the gasoline. Or the gasoline can be made temporarily useless by dumping sugar, linseed oil or similar substance into the tank. Water will not do; it simply sinks to the bottom.

Home defense units preparing to face an invasion should learn first how to take cover. Tom Wintringham, organizing Britain's home guards, told his people the Boy Scouts could teach them how to find cover and to move with as much use of cover as possible. Raw troops, he said, are eager to fight and expose themselves too much. Learn to dig a hole when lying on your stomach, and to make a valuable trench out of a useless straight ditch by cutting slots in the walls so that a man can hide from lengthwise fire along the ditch.

It was an army of farmers that fought the American war for independence; an army of home guards. Civilians today could not hope to oppose a mechanized invasion, but they could help with delaying tactics. And they can learn something about the use of weapons—a rifle or shotgun, a pistol, some sort of hand grenade. To use any of these weapons correctly you must be able to gauge distance to the target.

The hand grenade is a useful weapon for anyone. Any man or woman who can throw a brick should be able to do effective damage with a grenade. Actually a brick is not a bad instrument to start practicing with; lob it well up in the air to get distance.

The local defense units in England were taught to press the trigger of a rifle without jerking or shaking the barrel. They practiced lying prone, or crouching behind sand bags. They learned two essentials about pistols: first, never to assume that "it isn't loaded"; second, don't expect to affect a man at 20 yards range with a pistol unless you are a good shot already. Unless you are thoroughly used to a pistol, all you can do is wait around a corner or behind a door where you know an enemy is likely to come, then fire at point-blank range. Men who have never fired a pistol, however, can fire fairly well as soon as they learn how to judge distance, to aim correctly and to squeeze the trigger gently and firmly.

Several methods of halting tanks have already been described. One other, some-

times useful, is the antitank ditch. Dig a trench with one wall vertical and six feet high, the other wall slanted so that from ground level to the base of the vertical wall is about 15 feet. Bolster the vertical wall with cement, rails or ties, otherwise the tank could roll down the slope and grind away with its tracks until it has brought down enough earth to give it something to tread on and climb up. The sloping wall should be toward the anticipated tank attack. Near any tank trap or road block there should be bomb shelters.

But ahead of the tanks come the motorcyclists. If they can be spilled off their machines, get to them quickly; grab the rider's tommy-gun or pistol before an armored car comes along. If a motorcyclist is stopped down the road and there are no heavier vehicles in sight, the scout should be stalked with hand grenades.

"No tommy-gun can possibly hit you at 500 yards," Wintringham told the English volunteers. "At 200 yards it will not hit you if you are quick; at 100 yards or less it will cut you in half with bullets in two seconds. Keep this in mind when tackling parachutists or infantry armed with this weapon." Machine guns are dangerous at a half mile or less but cannot drill through a strong brick wall, three feet of earth or any solid barricade.

A house can be defended by knocking loopholes that command the ways of approach. Buckets of water should be handy, and blankets or curtains to cover the windows. These should be hung somewhat away from the windows so that the blast from a shell or hand grenade will not drive the glass through them. Two thick mattresses or a thick brick wall will stop a bullet. The home defender should be able to get into the attic, and to the roof if possible. Ground floor windows should be heavily barricaded, and stout timbers held ready to bolster a door against a hand grenade attack. And there must be some way for the defenders to escape; a "crawl trench" just deep enough to crawl along is sufficient.

These are the new ways of war civilians around the world are learning. Behind the armies are the homes, and in these homes men and women are preparing to stand off the invading tide as it reaches their door.

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Photo by U. S. Army Signal Corps



Any American would be glad to give all his tools to our fighting men. In the field, good tools like Crescent are almost as vital to victory as guns. Our men have these tools in abundance. That, perhaps, is the reason your tool kit is minus those Crescent Tools you tried to buy. Our war plants also use Crescent Tools by the thousands. They and our soldiers, sailors and marines come first. That's the way every American wants it. In the meantime, turn your tool money into Defense Stamps and Bonds—they're tools for victory too.

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(Photo at left) An Army Mobile Repair Shop puts a tank back in fighting trim, quickly, efficiently.



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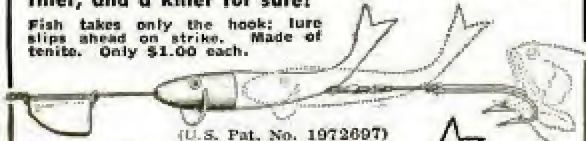
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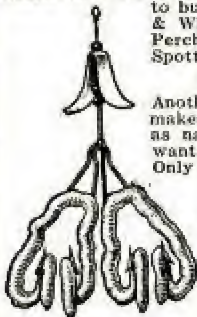
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INDIAN MOTORCYCLE CO., SPRINGFIELD, MASS.

Billions Waiting to Be Taken

(Continued from page 53)

precaution to ensure the safety of the huge treasure—everything except getting it ashore.

The gold and silver had lain aboard the cornered galleons several weeks when the British, joined by a number of Dutch ships, cruised up and went into action. Their troops took by assault one of the key forts. Then the fleet sailed full tilt toward the harbor barricade. With half a gale driving them, the attackers smashed through.

Within 30 minutes the bay was lit by the glare of blazing galleons, fire ships and men-of-war. Exploding powder magazines flung burning brands across the scene. The British and Dutch tried to save the treasure, but the Spanish commander gave orders that those galleons not sunk should be set afire. Next day the British sent divers to attempt to salvage some of the treasure, but they brought up little of value. Many salvaging companies have been formed since to raise this vast treasure, but they have recovered only about \$20,000,000 in plate and specie. The \$120,000,000 in gold and silver in Vigo Bay is one of the biggest unfinished salvage jobs in the field.

In the 19th Century, the greatest loss was the destruction of the Turkish and Egyptian fleets by the European allies of Greece in the Battle of Navarino Bay, October 20, 1827. The commander of a Turkish frigate made the mistake of firing on the flagship of Admiral Sir Edward Cedrington, Commander-in-Chief of the allied fleets. Out of that shot grew one of the most costly fights in the annals of sea warfare. For 18 hours the air was filled with bursting shells and the rattle of musketry. Fire ships spread havoc among close-packed ships. When the Turks and Egyptians surrendered, the last great battle of wooden navies was done and \$90,000,000 in gold and silver lay on the bottom.

Then came the 20th Century, and its huge share of sunken ships. There have been no losses to compare with the argosies of former centuries. There is not the same flow of actual treasure, but two of the more interesting wrecks were the "Merida" and the "Hampshire."

The "Merida" went down off the Virginia Capes, May 12, 1911, carrying \$5,500,000 including the notorious "cursed" jewels of

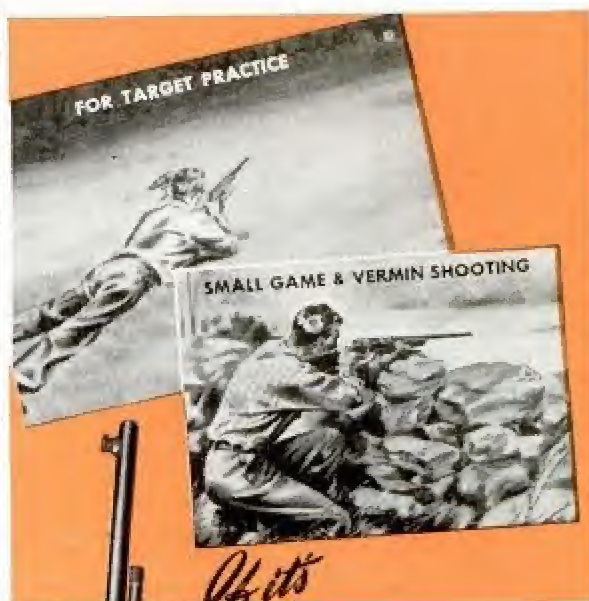
the Hapsburgs. According to the story, the jewels were first filched from a Burma temple by Count Hans Hermann. He was caught stealing the gems by a native priest, and when he killed the priest a curse was laid upon the Hapsburg family as long as the jewels should remain in their possession. Count Hermann was the first to die a violent death, and madness, murder, exile and accidents have pursued the Hapsburg dynasty to this day. The jewels were given to Maximilian and Charlotte of Austria when they came to Mexico to build a new empire. Their story ended in a firing squad for Maximilian, madness for Charlotte. Finally the gems were stolen by Porfirio Diaz, who attempted to get his treasures, together with 14 tons of silver to Europe on the "Merida"; but it was rammed in a fog and the Hapsburg treasure is part of Davy Jones's magnificent collection.

The "Hampshire" carried \$9,260,000 and England's famous Lord Kitchener, who was enroute as special wartime ambassador to the Russian Czar in 1916. In the black night on the North Sea the "Hampshire" struck a mine and sank immediately.

More than \$3,000,000,000 is the value set on the treasure held by Davy Jones. What are the possibilities of its recovery?

Eighty percent! And this may be accomplished with the scientific deep-sea devices, queer robots developed during the last ten years. The day of the traditional diving dress has passed. The modern era of submarine treasure hunting began with the observation bell; then came the "iron man" robot, which resembles some strange creature from another planet and which has a depth limit of 1,500 feet; this was recently followed by the toggle-jointed diving-sphere robot with a proved depth range of approximately 5,000 feet.

Recent interest in gold as a result of its increase in value has directed attention toward the sunken caches where vast fortunes are waiting the hand bold enough to stretch down through the dark pressure-packed waters to bring them to light again. With the ultra-modern equipment now available treasure expeditions may become one of tomorrow's "big businesses." Some day you may set out to find the wealth that has been spilled in the Seven Seas. It is still there—waiting for someone to take it.



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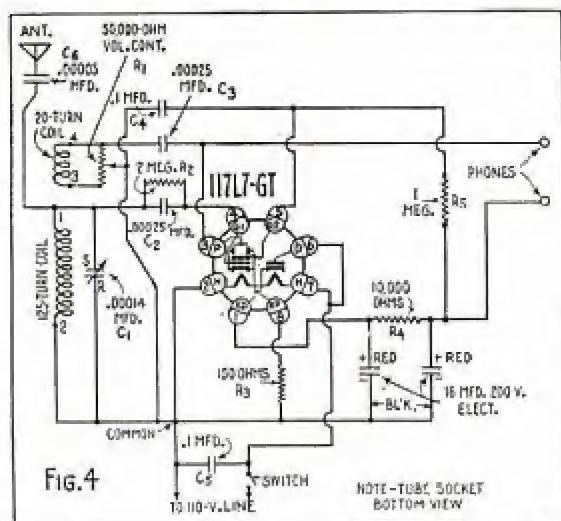
POPULAR MECHANICS

"Veep" A.C.-D.C. Receiver

(Continued from page 157)

is used. If the builder does not wish to wind his own coil, a midget unshielded R.F. solenoid coil of the 370-mmfd. type used in T.R.F. sets may be purchased from radio supply houses and adapted for use. Fig. 4 shows the schematic circuit diagram.

The type 117L7-GT beam-power pentode tube is a dual-purpose type, one half



being used as a detector and the other half as a rectifier; it operates directly off the 110-115 volt power line without bulky line-cord resistances. The tuning condenser is a midget size, 140 mmfd., mounted by means of an angle bracket. Although the parts appear crowded in the underside photo D, no difficulty will be encountered in wiring if the variable resistor (R_1) and the electrolytic condenser are installed last. A single soldering lug under one of the variable condenser mounting-bracket screws provides a common ground connection. Please note that no external ground is used. A detailed list of the original materials is available from Popular Mechanics radio department without charge, if desired.

Operated in the vicinity of local stations the set requires an antenna only 3 or 4 ft. long. For greater range connect the antenna lead to any ungrounded metal object such as a smoking stand, metal book shelf, hand rail or bed springs. For all normal purposes, the .00005 mfd. fixed antenna condenser is satisfactory. However, where

(Continued to page 183)

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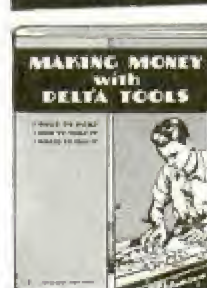


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The Delta Mfg. Co. (Dept. 681-E)
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local reception is best received between 1600 to 1300 kc., an adjustable 3-30 mmfd. trimmer condenser will provide better tuning. On the other hand, if reception is best from 600 to 550 kc. a 100-mmfd. fixed condenser will increase volume and sharpen



tuning. Although designed for headphones, this unusual one-tube set will operate a small speaker with good volume on local stations. The blueprint number for this article is R-303.

All-Wave 3-Circuit Tuner

(Continued from page 158)

shown in Fig. 2 and space the coils $\frac{1}{8}$ in. apart. Bring out the secondary taps at the designated number of turns by taking a twist of the wire around a match stick. Drill the finish holes upon completing each winding and leave sufficient wire to reach the terminal panel lugs.

Cut the terminal panel from a piece of heavy cardboard and mount the 6 large-hole soldering lugs by means of short machine screws and hex nuts. Final assembly is then made as shown in Fig. 3 using $\frac{1}{4}$ -in. 20-thread hex nuts, panel bushing and washers to mount the tickler coil shaft.

Cement or glue the cardboard terminal panel to the large coil form at rear, paint the windings with coil dope and solder the various coil leads to the terminal board lugs indicated. You are now ready to check with the coil diagram (C), after which the tuner is ready for mounting in your new receiver by means of the panel bushing. A tuning knob at the front of the set panel completes the assembly.



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Substitutes We'll Keep

(Continued from page 4)

A permanent change in the construction of screw bases for electric lamps is seen in the substitution of brass-plated steel for solid brass. Engineers say the substitute is less expensive and appears to be just as good. For wires that lead from the lamp base to the filament inside the bulb, nickel-plated steel has taken the place of solid nickel.

Strategic metals also play a part in the manufacture of porcelain—the material used for electrical insulation of power lines and in electric switches and transformers. Porcelain is made by molding a mixture of special clays into desired shapes, coating them with a glaze and baking at high temperatures in a kiln. This glaze, which appears as a hard, glasslike coating on the finished product, is applied as a watery mixture of many materials, including compounds of nickel, zinc and other metals. Engineers at Westinghouse started a search for a glaze without these strategic materials. When they succeeded a few months ago, they found they had a substance superior in many ways to the old. The new glaze increased the strength of porcelain 100 percent, producing a better insulator and one easier to manufacture and more resistant to weather.

Our research chemists have been working on an idea for an entirely new type of plastic. The material originally was intended for use in making parts of household appliances, to do away with sheet steel and thick walls of insulating materials. But because this same plastic promises to be useful to the United States Army, the research work has been pushed faster than planned, with good results.

So far plastics have been of two general types. One is the molded type which can be poured or pressed into molds to form such odd shapes as ash trays, fountain pens and small radio cabinets. But this type lacks the strength needed in some applications. The other type is known as laminated plastic. It is made by piling up layers of paper, cloth or other sheet material, impregnating them with resin and then hardening the resin under pressure and heat. This type has strength—sometimes equaling that of steel, weight for weight—but it is impossible to form it into

21415

complex shapes with sharp corners and other irregularities.

The new Westinghouse plastic is understood to combine the advantages of these two types. It is called a preformed plastic, because a mixture of wet pulp and resin is first formed in the general shape of the finished product. Then the piece is baked under pressure to harden the resin. The preformed plastic has the strength of the laminated plastic and the moldability of the molded type.

Our chemists are now working out methods to use this preformed plastic in several military items. One example is in the windshields, or streamline noses, of anti-tank shells which are now made of aluminum. These windshields must be lightweight to maintain balance of the shell, yet strong enough to prevent their flying apart as the shell whirls through the air at tens of thousands of revolutions per minute. Another suggested use for the new plastic is in a new, two-part army helmet. The inner part of this helmet is to be made of preformed plastic, which is strong but lightweight. This part could be worn by the soldier during ordinary field operations. During battle, the other part, made of steel, could be slipped on over the plastic part to give greater protection.

In another unusual development, porcelain is being used as a substitute for phenolic plastics. Phenolic plastics are compounded primarily from formaldehyde, phenols and cresols, all of which are in demand by our armed forces. Porcelain is being substituted satisfactorily; in many applications it has proved better than plastics. It lends itself to the manufacture of parts for ignition systems, thermostats for industrial furnaces and even stoppers for perfume bottles. Water-cooler parts formerly made of aluminum are being produced from this same type of porcelain, which also finds use as a substitute for hard rubber in making valve seats.

From these few examples, we can see that the war is bringing about the development of new products and processes that may prove better than any we ever had before.

Write to the firms listed in the Where-to-Buy-It index, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.



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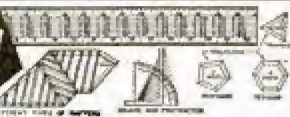
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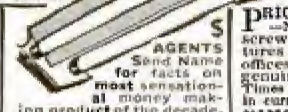


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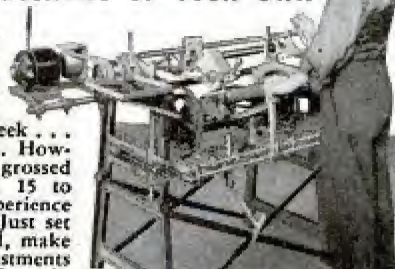
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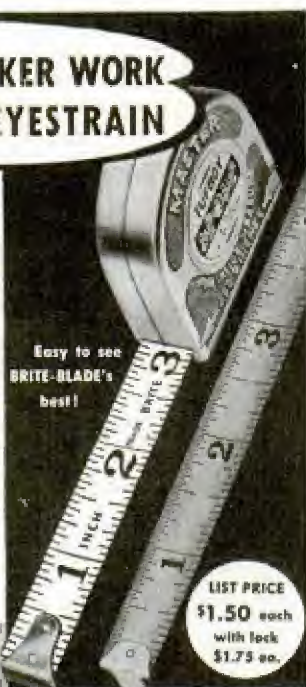
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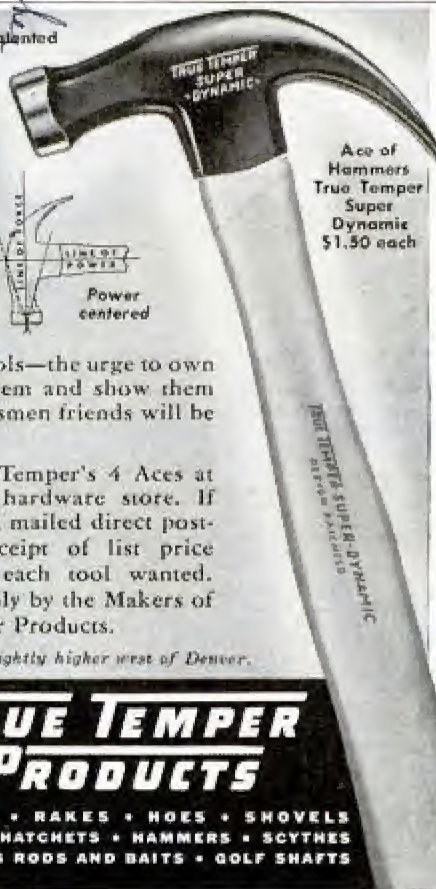
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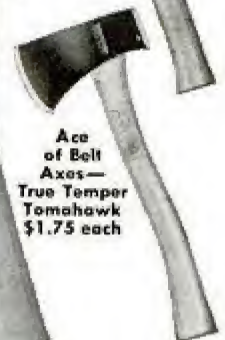
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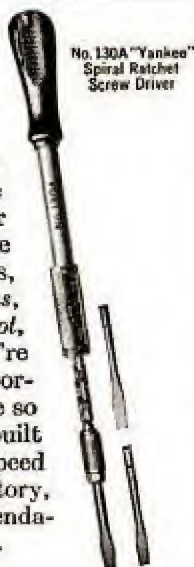
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**Make them like new with
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Good bristle brushes are now expensive—hard to get. Cabot's Brush Cleaner will clean your old hardened brushes right down to the heel. Just soak—then rinse with water. Harmless. Non-inflammable. Non-caustic. Does not evaporate. Will save you may dollars in brush costs. **SEND ONLY 25c.** If your dealer does not yet carry Cabot's Brush Cleaner, send 25c for ¼ pt. Please mention dealer's name.

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NAVY "E"

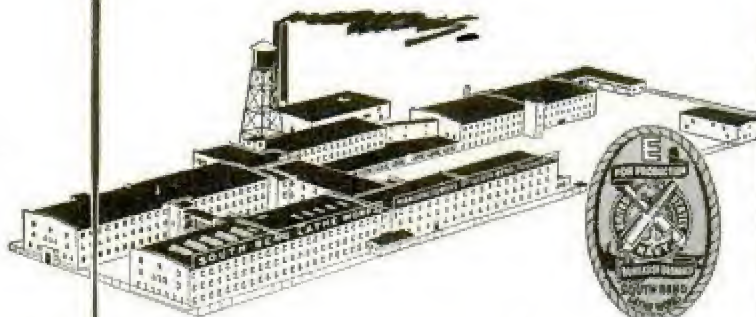
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**WORKS OFF
110 VOLT
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Many welders make as much as \$15 to \$20 a day. Repair jobs that can be done in less than an hour can make as much as \$5.00. Any number of jobs can be done more efficiently with welding. The DYNAMIC Super-Charged Welder, despite its serviceability, is so easily portable it can be carried around by hand and taken right to the job. This is an added feature whose value you will appreciate once you are in welding.

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With his eyes still focused on the batted ball... Joe follows through in a tremendous release of driving power.



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COUNTS WITH
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